Mathematical Computational Thinking Ability of Junior High School Students

Adi Ihsan Imami(✉), Muhammad Rijal Kamil, and Agung Prasetyo Abadi

Department of Mathematics Education, Universitas Singaperbangsa Karawang, Karawang, Indonesia
adi.ihsan@fkip.unsika.ac.id

Abstract. This research is motivated by students' mathematical computational thinking skills, which still need to improve. So, the goal of this study was to analyze and describe how students in Class VIII SMP think about math when they solve problems about probability. The research method used is descriptive qualitative. Data was gathered through tests and interviews. 6 students took the research subjects from 27 students at one of Junior High School in Jakarta for the 2020/2021 academic year. The study results showed that students in the low category could not achieve any indicators of mathematical computational thinking skills in the opportunity material. Students in the medium class can only master algorithm indicators in the ability to think mathematically, while the opposite is not achieved. Meanwhile, some students in the high category have achieved all indicators of the ability to think mathematically regarding opportunities.

Keywords: Mathematical Computational Thinking, Student Ability, Junior High School

1 Introduction

Mathematics's role is vital in improving students' abilities and significantly solving everyday problems. The purpose of learning mathematics is to prepare students to face changing circumstances in real life [1], [2]. There are advantages to developing computational abilities in the field of mathematics. Students, in particular, can develop computational and mathematical thinking in order to be developed in computer science, making students proficient in problem-solving and bringing science and mathematics education to the computer field [3]. Thus, it is clear that mathematical computational abilities are critical and need to be developed in learning mathematics [4]–[6]. In an interview with a math teacher at a junior high school in Jakarta, the teacher said that it was hard for students to use their computational thinking skills when they were learning math at school. Then, observations were made by giving questions regarding the ability to think mathematically; that is, students were asked to determine the value of syllables based on a sequence of numbers that could be formed from the problems given. Student answers are seen in Fig. 1.

M. Setiyo et al. (eds.), *Proceedings of the 4th Borobudur International Symposium on Science and Technology 2022 (BIS-STE 2022)*, Advances in Engineering Research 225,
https://doi.org/10.2991/978-94-6463-284-2_77

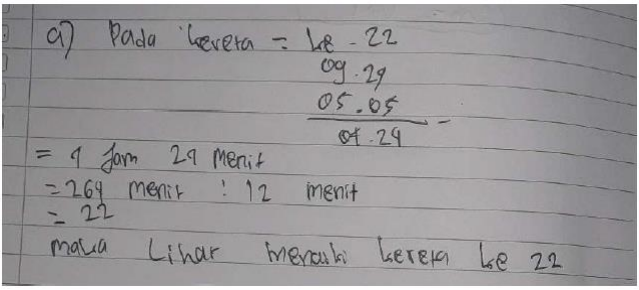

Fig. 1. Student's Answer

In Fig. 1, it can be seen that students have yet to be able to determine the appropriate steps in solving the problems given; students forget information about the first term. This shows that students in the algorithm indicators still need to be fulfilled. Where this indicator should be, Students can mention the steps to get the right solution in solving the problem.

This is consistent with the findings of other researchers, who discovered that the computational ability of students at one junior high school to solve mathematical problems is still low [7]–[9].

Suppose students have mathematical computational abilities, of course. In traverse, they will make a deep understanding of the mathematical concepts they are studying and can improve their problem-solving skills and be able to use computational thinking skills to acquire the knowledge needed in the era of globalization [10]. Therefore, research to conduct research to determine students' mathematical computational thinking abilities.

2 Method

This study used a qualitative approach. The method used is the descriptive method. This study's approach and methodology are being used to examine and characterize students' mathematical computational thinking skills. The people who were studied were 7th-grade students at a junior high school in Jakarta who took part in the study. Determination of the subject in this study was done by purposive sampling, taking it through specific considerations. The instrument used in this study was a test of opportunity material according to indicators of mathematical computational thinking skills. The data collection techniques were giving tests, giving non-tests, and documentation.

The data analysis technique in this study used the Miles and Huberman model, where the researcher reduced the unnecessary data at the data reduction stage so that the data obtained are following the objectives of this study [11]. The stages of data reduction in this research are as follows: (1) The researcher corrects the students' work which is then grouped according to the indicator of mathematical computational thinking skills, then determine which students will be the research subjects; (2) The results of students' work that will be used as research subjects which are raw data, are transformed into notes as

material for interviews. The data presentation was done by bringing up a collection of data that has been organized and categorized, which allows conclusions to be drawn.

3 Result and Discussion

The mathematical computational thinking skills test results were used as an instrument in this study to obtain data regarding the understanding of the concepts possessed by the research subjects. The results of the mathematical computational thinking skills test data from 27 students are as follows.

Table 1. The result of mathematical computational thinking skills

N	Min	Max	$\bar{x}$	SD
27	20	100	55,92	18,61

Table 1 shows that of the 27 students who took the mathematical computational thinking skills test, the minimum score was 20 and the maximum score was 100, with the mean score being 55.92 and the standard deviation being 18,61.

Based on the results obtained, researchers can group each student into each category, namely low, medium and high. Furthermore, to find out the categorization of students' mathematical computational thinking abilities can be seen in the following diagram.

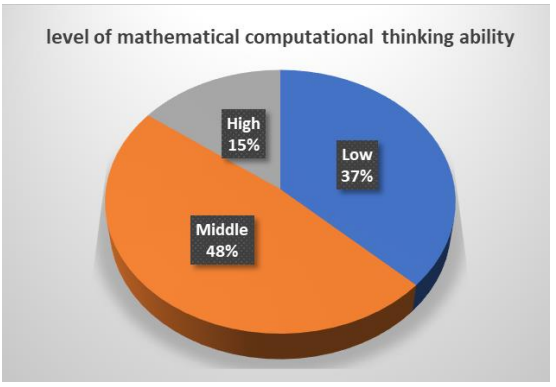

Fig. 2. Classification of mathematical computational thinking ability skill

Based on Fig. 2, it can be seen that out of 27 students, ten students (37%) are in a low category, 13 students (48%) are in the medium category, and four students (15%) are in the high with moderate computational mathematical thinking skills can only ls are only able to master algorithm indicators in mathematical computational thinking skills, while other indicators have not been achieved. In the algorithm indicator, students have been able to mention the steps for solving the problem properly and can solve the problem correctly. This can be seen from students' answers regarding questions that contain

algorithm indicators; students are asked to mention the steps in determining the right solution to solve the given problem.

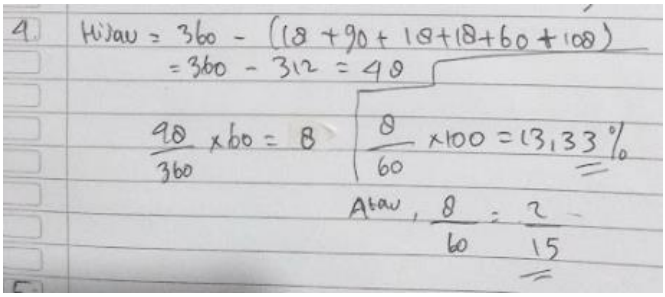

Fig. 3. student answer

It can be seen from Fig. 3 that students can explain exactly each step of the process, the first step that students take is to reduce 360 to the sum of all known circle degrees. The result is 360-312=48 so the green angle is 48 degrees. Then the next step is for students to look for the number of green candies, the method is 48 divided by 360 times the number of candies, which is 60, the result is 8 green candies. The third step is to determine the probability of picking a green candy, students divide the number of green candy by the number of candies and then multiply it by 100%, the result is 13.33%. In line with lestari research, it is also said that students in the medium category can explain the stages for solving questions and use information or concepts according to the questions even though the final stages are not perfected [12].The other research states that the ability of this algorithm is actually carried out by students in everyday life, for example, just brushing their teeth and so on. In the decomposition indicator students are able to correctly describe the problem given in a simpler form, but in determining the solution, it is still not quite right [13]. Decomposition is breaking a complex problem into smaller parts that are simpler and easier to work on [14]. Likewise on the abstraction indicator, students can identify problems and solve based on the information obtained, but the answers and selection of information needed in solving the problem are still wrong. Abstraction is focusing on the things that are important and ignoring things that are considered irrelevant [15], another thing in research [16] students in the medium group can fulfill the abstraction indicator. In the debugging indicator, students can check the correct or incorrect answers given [17], but students in this category, do not meet the debugging indicator because students cannot identify, delete, and correct errors from the given solving process. Also, the generalization indicator can't turn a problem into a set of opportunities that can be used for other problems. It is the same as the research conducted [18] that students still have not mastered generalization indicators.

4 Conclusion

Based on the results of the analysis and discussion, it can be concluded that the majority of students' computational mathematical thinking skills are in the medium category, but students' mathematical computational thinking abilities are still relatively low because students in the medium category are only able to master algorithm indicators in mathematical computational thinking skills. in comparison, the other indicators have not been achieved. Furthermore, students in the low category, students are not able to achieve all indicators of mathematical computational thinking ability. Meanwhile, some students in the high category have been able to achieve all indicators of the ability to think mathematically.

Acknowledgement. This research is funded by Universitas Singaperbangsa Karawang through the SIHIPKA that is managed by the Center of Research, Development, and Community Services of Universitas Singaperbangsa Karawang.

References

1. K. Gravemeijer, M. Stephan, C. Julie, F. L. Lin, and M. Ohtani, "What Mathematics Education May Prepare Students for the Society of the Future?," *Int J Sci Math Educ*, vol. 15, pp. 105–123, May 2017, doi: 10.1007/s10763-017-9814-6.
2. E. Mailani, N. A. Setiawati, E. Surya, and D. Armanto, "Implementasi Realistics Mathematic Education dalam Meningkatkan Keterampilan Berfikir Tingkat Tinggi/ HOTS pada Siswa Sekolah Dasar," *Jurnal Basicedu*, vol. 6, no. 4, pp. 6813–6821, Jun. 2022, doi: 10.31004/basicedu.v6i4.2855.
3. D. Weintrop *et al.*, "Defining Computational Thinking for Mathematics and Science Classrooms," *J Sci Educ Technol*, vol. 25, no. 1, pp. 127–147, 2016, doi: 10.1007/s10956-015-9581-5.
4. U. Nasiba, "Brankas Rahasia: Media Pembelajaran Numerasi Berbasis Berpikir Komputasi untuk Meningkatkan Kemampuan Pemecahan Masalah," *Jurnal Didaktika Pendidikan Dasar*, vol. 6, no. 2, pp. 521–538, Jul. 2022, doi: 10.26811/didaktika.v6i2.764.
5. A. Karim and A. Nurrahmah, "Analisis Kemampuan Pemahaman Matematis Mahasiswa Pada Mata Kuliah Teori Bilangan," *Jurnal Analisa*, vol. 4, no. 1, pp. 24–32, 2018, doi: 10.15575/Analisa.xxx.xxx.
6. J. Jamalludin, Imam Muddakir, and Sri Wahyuni, "Analisis Keterampilan Berpikir Komputasi Peserta Didik SMP Berbasis Pondok Pesantren pada Pembelajaran IPA," *JURNAL PENDIDIKAN MIPA*, vol. 12, no. 2, pp. 265–269, Jun. 2022, doi: 10.37630/jpm.v12i2.593.
7. L. I. P. Rahmadhani and S. Mariani, "Kemampuan Komputasional Siswa dalam Memecahkan Masalah Matematika SMP Melalui Digital Project Based Learning Ditinjau Dari Self Efficacy," *PRISMA, Prosiding Seminar Nasional Matematika*, vol. 4, pp. 289–297, 2021, [Online]. Available: https://journal.unnes.ac.id/sju/index.php/prisma/
8. A. C. Lestari and A. M. Annizar, "Proses Berpikir Kritis Siswa dalam Menyelesaikan Masalah PISA Ditinjau dari Kemampuan Berpikir Komputasi," *Jurnal Kiprah*, vol. 8, no. 1, pp. 46–55, Jun. 2020, doi: 10.31629/kiprah.v8i1.2063.
9. L. E. Marchelin, D. Hamidah, and N. C. Resti, "Efektivitas Metode Scaffolding Dalam Meningkatkan Computational Thinking Siswa Smp Pada Materi Perbandingan," *Jurnal*

Pengembangan Pembelajaran Matematika (JPPM), vol. 4, no. 1, pp. 16–28, 2022, [Online]. Available: http://ejournal.uin-suka.ac.id/tarbiyah/jppm/index
10. D. Barr, J. Harrison, and L. Conery, "Computational Thinking: A Digital Age," 2012. [Online]. Available: http://csta.acm.org.
11. Sugiyono, *Metode Penelitian Kualitatif*. Bandung: Alfabeta, 2018.
12. A. C. Lestari and A. M. Annizar, "Proses Berpikir Kritis Siswa dalam Menyelesaikan Masalah PISA Ditinjau dari Kemampuan Berpikir Komputasi," *Jurnal Kiprah*, vol. 8, no. 1, pp. 46–55, Jun. 2020, doi: 10.31629/kiprah.v8i1.2063.
13. A. Yadav, H. Hong, and C. Stephenson, "Computational Thinking for All: Pedagogical Approaches to Embedding 21st Century Problem Solving in K-12 Classrooms," *TechTrends*, vol. 60, no. 6, pp. 565–568, Nov. 2016, doi: 10.1007/s11528-016-0087-7.
14. G. Lestari Pratiwi, B. Akbar, M. Hamka, and U. Muhammadiyah Hamka, "Pengaruh Model Problem Based Learning Terhadap Keterampilan Computational Thinking Matematis Siswa Kelas Iv Sdn Kebon Bawang 03 Jakarta," 2022.
15. M. D. Marieska, D. P. Rini, N. R. Oktadini, N. Yusliani, and Yunita, "Sosialisasi dan Pelatihan Computational Thinking untuk Guru TK, SD, dan SMP di Sekolah Alam Indonesia (SAI) Palembang," *Prosiding Annual Research Seminar*, vol. 5, no. 2, pp. 1–4, 2019.
16. A. Alfina, "Berpikir Komputasional Siswa Dalam Menyelesaikan Masalah Yang Berkaitan Dengan Aritmetika Sosial Ditinjau Dari Gender," 2020.
17. M. Rijal Kamil, A. Ihsan Imami, A. Prasetyo Abadi, P. Matematika, and U. Singaperbangsa Karawang, "Analisis kemampuan berpikir komputasional matematis Siswa Kelas IX SMP Negeri 1 Cikampek pada materi pola bilangan," 2021.
18. N. Haya Julianti *et al.*, "Prosiding Seminar Nasional MIPA UNIBA 2022."