

Analysis problem solving skills of student in Junior High School

I D Franestian¹, Suyanta², and A Wiyono³

¹Science Education, Universitas Negeri Yogyakarta, Sleman, Indonesia

²Chemistry Education, Universitas Negeri Yogyakarta, Sleman, Indonesia

³ Science Education, SMPN 2 Donorojo, Pacitan, Indonesia

Corresponding author: invanaudit.2018@student.uny.ac.id

Abstract. This study to analyse the problem-solving skill on science learning in Junior High School. This study is a descriptive qualitative to analyse the result of problem-solving skill test. This study uses survey research method by using purposive sampling technique. The subject of this study is 80 students with low, medium, and high cognitive abilities according to the score of basic skill test upon new student admission. The instrument of the study uses five items of problem-solving skill test which have been validated and adjusted to several indicators of problem-solving skills. The result of the study shows that problem solving skill is still low in every indicator. The acquisition results of each aspect of problem-solving skills are 5.20% in identifying the problem, 57.60% in connecting the cause and effect, 47.10% in planning the solution, 37.60% in determining the relevant solution, and 39.10% in analysing the influence of solutions. In conclusion, the problem-solving skill of junior high school students in science learning is in low category.

Keywords: *problem solving, science learning*

1. Introduction

Problems and challenges of life in 21st century require readiness in dealing with problems in the real world which involve high-level thinking skill, creativity, communication, innovation, collaborative, critical thinking and problem solving skill. [1], [2]. In order to train and prepare the skill to face challenges in 21st century, learning activity needs to be improved and developed. Skills that need to be mastered include life and career skill, mastery of technology and information skill, innovation skill [3], social and cross-cultural skills, and leadership and responsibility [2].

All skills can promote by changing learning process in school. Teacher-centred learning should start to switch to student-centred learning. The student-centred learning offers bigger chance for students to be more active. Learning by memorising is no more used and switched to learning which encourage students to collaborate, open dialog, and encourage them to have critical thinking through effective behaviour modelling [1]. One of the skills in 21st century that needs to be mastered is problem solving skill. Problem solving is a basic skill that needs to be developed and trained to students in 21st century [4].

Problem solving is a summary of smart and rational cognitive process, thus, it provides a reasonable explanation for solution of the problem [5], [6] in other words, thought starts with the problem and ends with the solution [7]. Problem solving can be done by using senses and mind. That student can improve



the process (way of thinking) of problem solving is the most important aspect in education [8]. The process of problem solving needs several skills including planning, interpreting information, using methods, checking results [9], trying alternative strategy [10] and willing to accept help from others and colleagues [11]. Problem solving strategy has four steps, which are: understanding and representing the problem, planning and determining solutions to solve the problem, applying a problem plan, and evaluating the steps of problem solving [12]. Based on the interview with science teachers in junior high school, students can answer the question according to the concept, however, they will have difficulty when answering questions about concepts application in life. Then, in this problem, students understand the science concepts that have been taught yet they have difficulty in applying science concepts in daily life. According to research conducted by Sugiarto, students have difficulty in applying concepts in daily life which is the solution of the problem [13]. Based on the definition of problem solving, it can be concluded that aspects and indicators of problem solving used to analyse participant skills are on the table 1.

Table 1. Aspects and indicators of problem-solving skills.

Aspects	Indicator
Identifying the problem	Identifying the components of problem. Describing the cause-effect of components of the problem
Determining the alternative of problem solving	Planning several ideas or solution related to the problem
Applying the right solution	Determining the solution related to the problem logically and relevantly
Evaluating the result	Analysing the influence of solution that has been applied

2. Research method

This study used descriptive qualitative research to analyse the result of problem-solving skill test of seventh grade students on Junior High School in Pacitan regency. The subject of this study is 80 students with low, medium, and high cognitive abilities according to the score of basic skill test upon new student admission. The test consists of 5 questions which represent each problem-solving indicator and they have been validated by experts. The questions used were in the form of description. The assessment of test results used rubric score 1-4 to analyse and categorise the results. The percentage calculation of problem-solving skill used a formula:

$$NP = \frac{R}{SM} \times 100\%$$

Where SM= maximum score, R= raw value obtained and NP= expected percentage value.

Table 2. Criteria limitation assessment.

Score limit	Criteria
$\leq 54\%$	Less One/ Low
55-59%	Less
60-75%	Sufficient
76-85%	Good
86-100%	Very Good

3. Result and Discussion

The measurement results of problem-solving skill test on junior high school students in science learning are shown in figure 1.

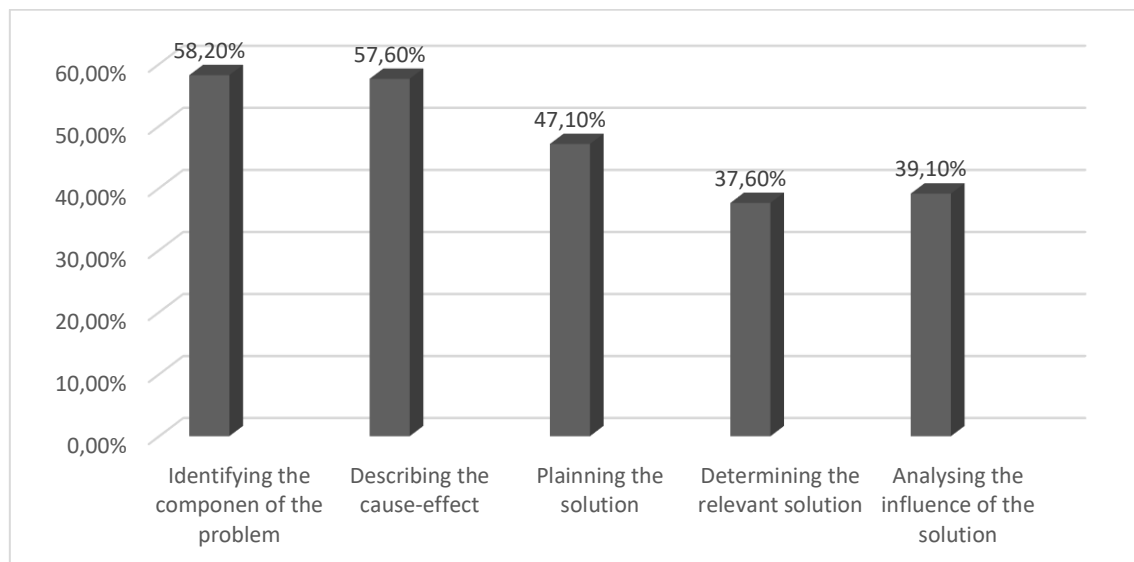


Figure 1. Percentage Analysis of junior high school student's problem-solving skill in science learning.

The aspects of identifying the problem include understanding components of the problem, determining and relating facts based on data, and determining formulas or questions of the problem. [14]. The aspects of identifying the problem in this study are divided into two indicators which are identifying components of the problem and describing cause-effects of the problem components. The problem discussed is water pollution which is faced in neighbourhood. This problem is expected to stimulate and motivate students to learn. Students are trained to think, ask, and analyse until they find right solutions to the problem [15]. The result of problem-solving test on indicator of identifying the problem is 58.20% and 57.60% which means it is in low category. The result of identifying problem aspects shows highest score among all aspects tested on students. Students may have been taught to identify the problem in previous stage and the problem has been mentioned in the text. The result by observing student's answers on this indicator is that most of them take or copy their answers from text which has been given. From that result, it can be concluded that student's knowledge is only limited on the text given.

An alternative of problem solving is by planning some ideas or solutions related to the problem faced. The result of this indicator shows that students' skills in planning solutions to solve the problem is still low. Student's answers are only limited to general knowledge and experience or it is less specific. It shows that student's knowledge in finding potential solutions to solve the problem is still low. This statement is based on the test percentage score that is 47.10 %. This result shows that the skills to make a potential plan to find solution is still in low category. The observation result in class shows that students have not been able to develop their thoughts of solution plan in long, short and medium term in solving a problem. Students must be trained to find solution to solve the problem in learning activity. Teachers should design learning activity that elaborates concepts with daily problems. Teachers design learning activity that encourages students to discuss some potential solutions to solve the problem. Teachers help students to identify whether those solutions can solve the problem in short or long time so that students will get the most effective and efficient solution.

The aspect of applying solutions by indicator of determining logical and relevant solution related to the problem shows lower results than other indicators' percentage. The observation result on the test shows that students find difficulty in determining solutions since they have never been taught by teachers in learning which starts with a problem. Students tend to only focus on the text. Students have not been

able to develop their thoughts to deal with problems since they are not used to face problems and find solutions to solve those problem. The result also represents that students do not have the skills to think at a higher level yet. Problem solving skill is a skill of thinking at a higher level so students can formulate a solution of problems they faced [16].

The aspect of evaluating the result by indicator analysing the influence of solutions related to the problem. Students are required to understand the influence of solutions, they chose all in terms of energy, cost and time. The percentage result on this indicator is low category that is 39.10%. This result shows that students have not been able to develop their thoughts on deeper understanding about the determined solution. Students are not used logical thinking to predict the impact and influence of the solution application to solve the problem.

The percentage result of problem-solving skill test and result of the interview on students about their obstacles in answering questions shows that students find difficulty because they forget the theory and they pay less attention to the important things in questions given so that their answers are not quite suitable. This result represents that students only focus on text since they only have been taught by memorising technique and have not been trained to solve problems in the learning activity. Students only recognise problems and concepts but have difficulty to implement and evaluate relevant solutions. Many students are not aware and confuse how to apply their knowledge and concepts to solve the problem [17]. Students need to practice often so they are able to apply the concepts [18]-[20].

Problem solving skill can be trained through concept and knowledge comprehension in learning. The concept comprehension can be done by contexts learning that aims to develop student's thinking skill [16]. Problem solving skill can be facilitated by learning activity where students can elaborate new knowledge with the knowledge they have been learned before [14]. Students are required to develop problem solving skills in learning. Problem solving skill can be improved through science learning. Students are encouraged to be creative, to make decisions, to think critically and analytically, so that students are expected to find ease in finding solutions to problems or problem solving skills in life [1] that will be seen by certain behaviour [4], [21].

The influential factors of problem-solving skill are structure of knowledge and character of problems faced. The structure of students' knowledge is related to their initial knowledge that have been learned in form of science products such as theory, fact, law, principle, and postulate [22]. From the result of the analysis of problem-solving skill, it can be identified several factors which influence students' skills. Those factors are: (1) the experience factor includes background knowledge that students already have before; students are used to deal with problems. (2) the cognitive factors or students' thinking skills includes students' skills to read; analytical and logic skills. (3) the affective factor or attitude including accuracy, perseverance and patience.

4. Conclusion

Based on the result of the study that has been conducted, it can be concluded that problem solving skill of seventh grade students in junior high school is still in low category. Teachers are expected to design learning activities using science learning media related to daily life that aims to maximally improve all aspects of problem-solving skill.

References

- [1] Živković L, S 2016 *Proc. Int. Conf. on Teaching and Learning English as an Additional Language (Antalya)* vol 232 (Amsterdam: Elsevier) p 102-108 <http://doi.org/10.1016/j.sbspro.2016.10.034>
- [2] Ongardwanich N, Kanjanawasee S and Tuipae C 2015 *Proc. World Conf. on Edu. Sci. (Malta)* vol 191 (Amsterdam: Elsevier) p 737-741 <http://doi.org/10.1016/j.sbspro.2015.04.716>
- [3] Laar E, Deursen A J A M, Dijk J A G M and Haan J 2017 *Computers in Human Behavior*. 72 577-588 <http://doi.org/10.1016/j.chb.2017.03.010>
- [4] Florea N M and Hurjui E *Proc. Int. Conf. Edu World (Pitesti)* vol 180 (Amsterdam: Elsevier) 565-572 <http://doi.org/10.1016/j.sbspro.2015.02.161>

- [5] Dostál J 2015 *Proc. Int. Conf. on New Horizons in Education (Paris)* vol 174 (Amsterdam: Elsevier) p 2798-2805 <http://doi.org/10.1016/j.sbspro.2015.01.970>
- [6] Karaback K, Nalbant D and Topçuoğlu P 2015 *Proc. Int. Conf. on New Horizons in Education (Paris)* vol 174 (Amsterdam: Elsevier) p 3063-71 <http://doi.org/10.1016/j.sbspro.2015.01.1099>
- [7] Ngang T K, Nair S and Prachak B 2014 *Proc. World Conf. on Edu. Sci. (Rome)* vol 116 p 3760-64 <http://doi.org/10.1016/j.sbspro.2014.01.837>
- [8] Sulak S 2010 *Proc. WCLTA (Cairo)* vol 9 (Amsterdam: Elsevier) p 468-72 <http://doi.org/10.1016/j.sbspro.2010.12.182>
- [9] Pratiwi S, Prahani B K, Suryanti S, and Jatmiko B 2019 *Proc. Int. Conf. on Mathematics and Science Education (Bandung)* vol 1157 (Bristol: IOP Publishing) p 1-6
- [10] Intaros P, Inprasitha M, Srisawadi N 2014 *Proc. World Conf. on Edu. Sci. (Barcelona)* vol 116 (Amsterdam: Elsevier) p 4119-23 <http://doi.org/10.1016/j.sbspro.2014.01.901>
- [11] Şengül S and Katranci Y 2012 *Proc. Int. Conf. on Edu. and Educational Psy. (Istanbul)* vol 69 (Amsterdam: Elsevier) p 1650-55 <http://doi.org/10.1016/j.sbspro.2012.12.111>
- [12] Nurkaeti N 2018 *Jurnal Pendidikan Dasar*. **10** 140-7 <http://doi.org/10.17509/eh.v10i2.10868>
- [13] Sugiarto M, Yani A and Amin B D 2016 *Jurnal Sains dan Pendidikan Fisika*. **12** 183-91 <https://doi.org/10.35580/jspf.v12i2.2171>
- [14] Mauke M, Sadia I W and Suastra W 2013 *Jurnal Pendidikan dan Pembelajaran IPA Indonesia*. **3** 2
- [15] Seyhan S G 2015 *Asia-Pacific on Science Learning and Teaching*. **16** 1-31
- [16] Sukmasari V P and Rosana D 2017 *JUPI*. **3** 101-10 <http://doi.org/10.21831/jpii.v3i1.10468>
- [17] Ricketts J and Rudd R D 2004 *Journal of Agricultural Education*. **46** 32 <http://doi.org/10.5032/jae.2005.01032>
- [18] Fahim M 2012 *International Journal of Education*. **4** 153-60 <http://doi.org/10.5296/ije.v4i1.1169>
- [19] Haseli Z and Rezaii F 2013 *European Online Journal of Natural and Social Sciences*. **2** 168-75
- [20] Lederman N G, Lederman J S and Antink A 2013 *IJEMST*. **1** 138-147
- [21] Cheng M H M and Wan Z H 2017 *Thinking Skills and Creativity*. **24** 152-63 <http://doi.org/10.1016/j.tsc.2017.03.001>
- [22] Cheng S C, She S C and Huang L Y 2018 *EURASIA J.Math. Sci Tech. Ed*. **14** 731-43 <https://doi.org/10.12973/ejmste/80902>