Potential solving mathematical problem students focused on self-directed learning in COVID-19 pandemic

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Abstract. The purpose of this research was to depict the mathematical skill of high-school 1 Jeruklegi, 7th-grade students, who have been examined by their teaching in Cilacap Indonesia. This research was a descriptive qualitative analysis. The outcomes of self-directed learning problems, tests on mathematical problem resolution, and interviews collected the data from this research. The data use a method of triangulation. Students were divided into three classes based on the questionnaire’s findings, namely students in the high, medium, and low self-directed learning categories. A purposive sampling technique was used to determine the research subjects. Data from the test and interview were used to identify the mathematical problem-solving abilities of the students. The results of this study show that students with the high self-directed learning group were able to fulfill the indicators of understanding the problem, compile a solution plan, do calculations according to the plan, and check the results obtained. However, the respondents were only able to fulfill the indicators of understanding the problem in the medium self-directed learning category, compile a plan for completion, and do calculations according to the plan. Meanwhile, in the low self-directed learning category, respondents were capable of following the standards to complete the steps to understand the issue and formulate a response plan.

1. Introduction
Indonesian mathematics education's vision notes that mathematics education is committed to learning mathematical principles and ideas that are then implemented in routine and non-routine problem-solving through the creation of reasoning, communication, and relations inside and outside mathematics itself [1]. Students are supposed to be able to use mathematics and mathematical reasoning, as well as studying the subjects of science in everyday life [2]. The results of PISA's 2013 data analysis indicated that mathematical and science competencies contribute significantly to problem-solving across the world [3]. The primary aim of mathematics teaching is to encourage students to solve daily issues [4]. A problem solver can be valuable in the world of work [5].

Bahar and Maker [6] explained that scientists call the principle of problem-solving a high-level process of thought that comprises intellectual abilities and essential cognitive processes. The ability of students to solve problems can be described as the ability of students to identify problems, prepare problem-solving strategies, execute selected strategy and revisit problem resolution so that solutions can be subsequently established in another way [7]. Although mathematics is a very important topic of informal education and is closely linked to human life, mathematics is not a topic of student interest. Indonesian students still have the low mathematical problem-solving ability [8].

Simamora et. al [9] reported that teachers' results indicated that a word problem is very difficult for students in mathematics. It was also found, because mathematics was too hard for these students, that many students did not like math. These reports show that Indonesia still has a long way to go from...
achieving its mathematical education vision. The capacity to solve problems is a very important aspect of the ability to think at a higher level. The low ability to resolve mathematical problems is a key problem.

Information technology is an important topic because today all day-to-day activities are technologically related. To carry out all activities easily, technology plays an important role. Now we are in an era of explosion of knowledge and information is available everywhere. Traditional class learning is therefore not sufficient to gain the full benefit of the excess information. The only solution students should try to use their knowledge and expertise to process information. This is how self-directed learning in the field of education is important and utilized. Autonomous learning assists students in gaining information and acts as a sign for lifetime learning [10].

A problem is a condition in which a person is consciously motivated and challenged to solve it, and there is no immediate way to solve the problem [11]. Problem-solving can be done well if someone has problem-solving skills. Problem-solving skills are higher-order thinking skills because the problem-solving process involves knowledge skills, and it takes more steps than memorizing [12]. According to Branca, (in Sumartini [13]) problem-solving ability is very important for every student because (a) problem-solving is the general goal of teaching mathematics; (b) problem-solving which includes methods, procedures and strategies is a core and main process in the mathematics curriculum; (c) problem-solving is a basic skill in learning mathematics. If students are trained in problem-solving skills, students will have skills in obtaining relevant information, processing information to solve problems, and realizing how necessary it is to check the results that have been obtained.

Soemarmo and Hendriana [14] suggest that the indicators of mathematical problem-solving abilities are as follows: (a) identifying the elements that are known, asked for, and the adequacy of the elements needed; (b) formulate mathematical problems or compile mathematical models; (c) implement strategies to solve problems; (d) explain or interpret the results of solving the problem. Based on the steps and problem-solving indicators according to the experts above, the researchers took the indicators of mathematical problem-solving abilities as follows. Students can mention information from the questions given (write down what is known and asked). Students can make plans for solving known things by writing formulas. Students can solve problems through plans that have been made with the correct calculation results. Students recheck the steps they use against the answers that have been obtained.

As the COVID-19 pandemic progresses, many governments take steps to limit the number of people gathered in public places. The regular operations of schools and colleges have been affected by such initiatives. Since this measure is extensive and will likely continue in some countries for a certain time until a vaccine is provided by leaders of public and private education institutions, alternative methods have been put in place for students and faculty to continue learning when school is not possible and methods are being developed which will make schools suitable for wherever they are [15].

Differences in the capacity of different types of schools to support students’ education remotely and the differences between students in their resilience, motivation, and skills to learn independently and online are probably the most exacting feature in the student support process for parents who provide them with educative opportunities directly home or in private. Furthermore, discrepancies among school districts in their ability during the necessity to plan and execute successful approaches to education will intensify resources among jurisdictions [16].

As a result, the COVID-19 pandemic will most likely create the greatest disturbance in education opportunities worldwide in a generation without an intentional and efficient education response. This disease will harm people's livelihoods and their societies’ prospects. In the sense of this fresh and daunting digital learning situation created by COVID-19 school locks in classrooms, education policy and procedure need to be told immediately. Some countries have experienced natural catastrophes (e.g. earthquakes or floods) that have led to regional school look-ups, but these have not necessarily led for weeks to digital learning. Although a pandemic triggering systemic chaos and a subsequent school shutdown has not yet been encountered in many countries, there is restricted awareness about how to address existing circumstances and problems resulting from digital learning [17].

2. Method
This research is a qualitative descriptive study. This research conducted by giving self-directed learning questionnaires and a problem-solving ability test to seventh-grader students by coming to their homes. This was carried out due to the COVID-19 pandemic conditions which required students to stay at home. Teaching and learning activities in schools face to face are considered to be prone to transmission by students, teachers, and parents. Respondents amounted to 31 students with 15 male students and 16 female students. After giving the self-directed learning questionnaire, the researcher categorized the students based on the questionnaire scores into 3 groups, namely high self-directed learning, moderate self-directed learning, and low self-directed learning.

The research subjects were selected using a purposive sampling technique. Test and interview data were used to describe students' mathematical problem-solving abilities. The results of this study showed that students with the high self-directed learning group were able to fulfill the indicators of understanding the problem, compiling a solution plan, doing calculations according to the plan, and checking the results obtained. However, in the medium self-directed learning group, the respondents were only able to fulfill the indicators of understanding the problem, compiling a solution plan, and doing calculations according to the plan. Meanwhile, the respondents in the low self-directed learning group were able to meet the indicators of completing the steps to understand the problem and compiling a solution plan.

3. Result and Discussions
Quantitative data from the results of the student's self-directed learning (SDL) score obtained from 23 students. To determine the high, medium, and low self-directed learning groups, the researcher used the calculation of the mean and standard deviation.

| Categories of SDL | Criteria                  |
|------------------|---------------------------|
| High             | SDL Score > 81.528        |
| Medium           | 61.602 ≤ SDL Score ≤ 81.528 |
| Low              | SDL Score < 61.602         |

From table 1, it can be seen clearly that the total score of the questionnaire results was 1646 with an average of 71.565 and a standard deviation of 9.963.

Students in the high self-directed learning group have able to achieve all steps of mathematical problem-solving abilities. First, at the stage of understanding the problem, students can understand the information of the questions. They write in an easy way to understand. During the interview, they were able to properly state the information that was known from the items. Second, in planning the completion, these students have been able to write formulas to solve the items correctly and following the information provided on these items. Students are consistent in writing the name of the formula in the problem-solving plan. Besides, students also use communicative language when explaining the plan for completion. This shows that students with a high self-directed learning group can plan problem-solving well. Third, at the calculation stage, they use a method that is to substitute what was known in the previous stage. This means that students rely more on the formulas they already know. Then they use the formula to find the value in question. Also, students can get the right answer, students also do not forget to write down units in the answers obtained. At the last, at the stage of reviewing processes and results, students generally have found a way to re-examine the processes and results that they have worked on. Students work by taking what is already known, being asked, or reversing the process. At the time of the interview, students who did the answers correctly seemed confident in the results of their work.

The group of students with medium self-directed learning. First, at the stage of understanding the problem, students who are self-directed learning are already able to understand the information in the questions well. This is shown by students being able to write down the information they know about the questions properly. In writing, Even though the students still use a slightly long language and have not
used the points they know, but it's still easy to understand. This shows that they have been able to master the stage of understanding the problem in each given mathematical problem-solving ability. The second stage is planning for completion. Students in this group can write formulas to solve the items. However, some students write another way at this stage. This shows that students can plan problem-solving solutions. In the next step, students perform calculations according to the plans made to solve the problem, at this stage, students can work until they get the right answer, and write down the correct units in the answer. At the last, at the stage of reviewing processes and results, students have not been able to check the answers obtained. However, there is still one student who checks back by reworking and the correct answer. During the interview, students were able to follow the direction of the researcher well.

The group of students with low self-directed learning. First, at the stage of understanding the problem, students are mostly able to understand the problem, indicated by writing down all the information in the problem as things that are known and what is being asked. However, when writing down known information on the questions, students more often than not written down the things that were known and what was asked using the same sentences as the items. In other words, use long sentences, don't just write down the bullet points. In the second stage of planning problem-solving solutions, students are still able to plan solutions. They are still writing formulas that will be used at a later stage, even though they are not equipped with sentences to clarify how the flow of doing them is. In the third stage, at the calculation stage, students are still wrong in substituting values into the formula so that the results obtained are also wrong. They are also less systematic in writing down their answers. Besides, they do not master numeracy techniques well. In this case, it can be said that they have not mastered the problem-solving strategy. At the last, at the stage of reviewing processes and results, In this group, students have not been able to re-check the answers obtained, because students think that students do not need to check again with an example. Our students are not used to checking the answers that have been obtained. During the interview, they also said they were confused about how to check again.

4. Conclusion
Based on the results of the analysis that has been obtained, it is concluded that students with the high self-directed learning group can fulfill 4 indicators of mathematical problem-solving abilities, namely, understanding problems, planning solutions, performing calculations, and checking results and processes. During the interview, students are more confident and communicative in answering the questions given. Students with moderate self-directed learning groups can fulfill 3 indicators of mathematical problem-solving abilities, namely understanding problems, planning solutions, and performing calculations. Students with low self-directed learning groups can fulfill 2 indicators of mathematical problem-solving abilities, namely understanding problems and planning solutions.

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