

# In-service teachers' mathematical problem solving skills

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**Submission date:** 15-Jun-2024 05:46AM (UTC+0700)

**Submission ID:** 2401133408

**File name:** Hiltrimartin\_2020\_J.\_Phys.\_Conf.\_Ser.\_1480\_012055.pdf (1.08M)

**Word count:** 2333

**Character count:** 12968

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To cite this article: C Hiltrimartin *et al* 2020 *J. Phys.: Conf. Ser.* **1480** 012055

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## In-service teachers' mathematical problem solving skills

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**Abstract.** This study aims to describe the problem-solving skills of in-service teachers. The background of this study is because teachers are less concerned with developing problem-solving skills and rarely gave problem-solving problems. The research method used is a qualitative method. The research subject are the in-service teacher. The data collected with the test technique, in the form of a problem-solving item. The results showed that the ability of teachers in large solutions is still lacking because teachers still have difficulty.

### 1. Introduction

A good teacher must have several qualifications such as personality traits, attitudes, beliefs, pedagogical skills and knowledge [1]. Based on the understanding given by Kothari and Pingle about personality and traits [2], what is meant by the personality and traits of a teacher is a unique and relatively stable behavior, emotions and thoughts of a teacher are interacting with her/his students. These personality traits include patience, friendliness towards students, acceptance of students' existence, creativity, and everything that contributes to the progress of the teacher [1, 3]. Besides, the personality traits of the teacher occur both inside and outside the classroom [4]. Next, there are five professional characteristics of the teacher in the field of personality traits and attitudes, namely, professionalism, thinking, expectations, leadership, and relations with other [1, 5].

The other qualifications are pedagogical skills and knowledge. Pedagogical skills are the high-level creativity of teachers' attitudes toward organizing communication with students [6, 7]. For teacher to be creative teaching, it is need pedagogical knowledge. Thus, pedagogical knowledge is the specific knowledge of teachers to create a teaching-learning environment that are effective for students [8]. That knowledge includes subject knowledge, knowledge of learners, teaching methodology, curriculum knowledge, general pedagogical knowledge, knowledge of contexts and knowledge of self [6, 8].

Subject knowledge is material related to scientific knowledge taught to students [6], for example, mathematics. The subject knowledge of mathematics is related to facts, concepts, principles, and procedures. So, the teacher must have the skills to convey the subject. One of the subject knowledge skills that are mastered by the mathematics teacher is skill [9]. The problem-solving skill is the ability to find solutions from the problem. Problems that arise to practice problem-solving skills in mathematics are usually non-routine problems. Strategies used to solve them, with strategies that are not procedural.

The ability to solve a problem in life has many benefits for individuals. Although not all the problems we face are mathematical problems, to solve those problems not a few that require mathematical thinking. The ability to solve problems can be practiced at school and one of the memorable subjects to practice problem-solving is mathematical subjects [10, 11].



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Problems solving in mathematics can be defined as using mathematical concepts, principles, and skills to complete non-routine tasks. According to Polya [10], there are four steps to solve problems. The first step is understanding the problem. Without it, student will not be able to find the right solution. The next step is to design a problem solving strategy. After that, carry out the strategy. The final step is to re-examine the resolution obtained to the problem at hand.

The problem-solving ability are also used as a benchmark for competency achievement in TIMSS and PISA studies. This is because the TIMSS and PISA questions are a type of problems solving. The result of the 2015 PISA study showed that Indonesia ranked 63 out of 72 participating countries [12].

One of the causes of low student achievement in mathematical field is the students' ability to solve problems that demand high thinking and reasoning abilities is still very low. Besides, it is also caused by the learning process that has been applied at school, emphasizing students to memorize formulas rather than understanding concepts [13]. It is not only that, but also the lack of students' understanding of the term [14]. It was also found that most of teachers are less concerned with developing the problem-solving skills [15]. Besides, the mathematics teachers at Palembang State High School (SMA) rarely gave problem-solving problems to students [16]. According to the research, there was a positive and significant relationship between the ability to master mathematical knowledge of the teacher and the learning achievement of students [17]. The other word, teachers are the spearhead in efforts to improve the quality of services and educational outcomes. In short, teachers are the main key in efforts to improve the quality of education. Therefore efficient problem-solving skills are one of the basic competencies that teachers must-have.

The teachers must give more problems than providing concepts [18]. From the teacher's collaboration with students in solving problems, Holey states learning to solve problems is more valuable than other learning [18]. The teacher has a role to improve the ability to solve problems with mathematical modeling so students can use the methods used, or by evaluating the form of making questions that support [19].

To improve the quality of education, the main aspect determined is the quality of the teacher. Whether or not the students succeed in studying at school, one of them depends on the educator. Considering the existence of educators in the process of teaching and learning activities is very influential, then the quality of educators should be considered and improved. One effort that can be done through teacher education qualifications by the minimum requirements specified professional teacher requirements.

The government, in the context of improving the quality of national education through improving the quality component of teachers, has launched a teacher certification program, known as an in-service teacher. Teacher certification is the process of awarding certificates to teachers who have met professional teacher standards. The government hopes that from this certification program teacher professionalism will improve so that in the end, the quality of education will also improve.

Teachers in positions that take part in education and equality tests both funded by the government, regional government and at their own expense are carried out while still carrying out their duties as teachers. The teacher professional education program has a learning burden that is set based on the background requirements of the scientific field and the education unit where the assignment is assigned. In the program, they are equipped with material to become effective teachers, including problem-solving skills. It must be possessed by the in-service teacher. The purpose of this study is to determine the ability of teachers to solve mathematical problems at the stage of professional.

## 2. Method

This study aims to know the ability of in-service teachers to solve problems. Therefore, methodology is quantitative methode. The subject in this study was 13 junior high school teachers and 17 high school teachers who took part in the teaching profession (PPG) class 5 of 2019 at FKIP Universitas Sriwijaya. To measure the ability of teachers to solve problems used tests and analyzed based on indicators of problem solving including identifying elements that are known or understand the problem, determine strategies, implement strategies and check the correctness of the answers.

### 3. Result and Discussion

#### 3.1. Description of Data

The instrument used was an instrument in the form of a sheet test of mathematical problem-solving ability. This instrument is used to determine students' mathematical problem-solving abilities in solving problems based on mathematical problem-solving indicators. Students are considered correct in solving problems if in the answers to each test item there are all components in the indicator of problem-solving abilities, namely: (1) understand problems, (2) determine the solving problem strategies, (3) implement strategies to solve problems, and (4) look back at the settlement by checking the truth the settlement obtained and interpreting the results.

Sebuah pabrik menyediakan fasilitas antar – jemput bagi pegawai dengan pembebaran ringan, ialah Rp. 1.000,- per km jarak per minggunya, jadi yang dijemput pada km 4,8 (48 km) harus membayar Rp. 48.000,- per minggunya. Sekarang pimpinan pabrik akan mengganti alat angkut karyawan yang biasanya pick up dengan penumpang maksimum 9 orang, dengan bus mini dengan kapasitas 30 orang, tetapi dalam jarak 1 km, bus hanya akan berhenti di satu tempat saja.

Dari data jemputan yang lampau, untuk suatu daerah di antara km 6 dan km 7 terlihat distribusi peserta sebagai berikut :

Km	6,1	6,2	6,3	6,4	6,5	6,6	6,7
Peserta	2	5	6	4	3	1	2

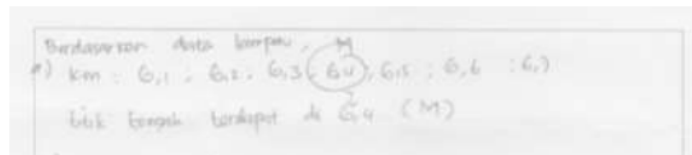
orang

Jika pimpinan ingin supaya tarif tidak berubah dan juga penerimaan total tidak berubah, maka :

1. Dimanakah seharusnya tempat pemberhentian bus untuk daerah tersebut diatas ? (namakan M)
2. Berapa ongkos mingguan yang baru bagi mereka yang dijemput di-M tadi ?
3. Alat apa yang digunakan untuk menyelesaikan model ini ?

**Figure 1.** The problems is given to measure problem-solving skills.

Figure 1 shows the problem that must be solved by the research subject. They must use strategy to solve that problems, namely Polya's four steps [10]. Figure 2 shows one of the subject's answers.



**Figure 2.** The subject's answer for problem number 1.

Figure 2 shows the answer for number one. Subjek resolves the problems using the drawing strategy of the terminal position it should be.



**Figure 3.** Subject's answer for number 2.

Figure 3 shows the subject's answer for number 2. Subject use the strategy to determine the price of transportation to be paid.

### 3.2. Analysis of Data

After the test is carried out, the test result data that has been obtained are analyzed to find out the mathematical modeling abilities of students. The test results obtained are then examined and given a score based on the scoring guidelines that have been made by researchers. Next, the researcher determines the category of mathematical modeling abilities possessed by students which are very good, good, sufficient, lacking, or very lacking.

**Table 1.** Teachers' abilities in problems solving

Score	f	%	Categories
0 – 20	2	6.7	Very lacking
21 – 40	11	36.7	Lacking
41 – 60	8	26.7	Sufficient
61 – 80	6	20	Good
81 – 100	3	10	Very good

Table 1 shows that there are 10% of teachers who are very good at solving problems. Most of the teachers (43.4%) have lacking and very lacking abilities.

From the results of the test given to the teachers, based on indicators of the ability to solve obtained data about the ability of teachers as follows:

**Table 2.** The problem solving ability category is based on the problem solving ability indicator

Indicators	$\bar{x}$	sd	$\frac{\bar{x}}{x_{max}} \times 100\%$	categories
Understand the problems	2.56	0.8	61.00	Sufficient
Determine the completion strategies	1.63	0.6	40.75	Lacking
Impelement a settlement strategy	1.45	0.7	36.25	Lacking
Look back at the settlement	1.26	0.2	31.50	Lacking

Table 2 shows that the teachers' abilities to solve problems in each indicator in the category are lacking, only in understanding the problem is in the sufficient category.

From the data description of the teachers' work results obtained that the teacher is less able to solve the solving problems. This is due to mathematical abilities that are not good. Most teachers are weak in compiling mathematical models. This weakness causes an error in the answer. In addition, teachers are also not accustomed to reexamining which results in unknown errors in completion.

#### 4. Conclusion

The ability of teachers to solve mathematical problems is largely in the poor category. Judging from each indicator the ability to solve problems is not good this causes the lack of students' ability to solve problems.

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