International Journal of Science and Applied Science: Conference Series P-ISSN: 2549-4635
Int. J. Sci. Appl. Sci.: Conf. Ser., Vol. 4 No. 1 (2020) E-ISSN: 2549-4627
Current research in Pandemic Covid-19 Era in Indonesia - 2nd ICOSETH 2020 doi: 10.20961/ijsascs.v4i1.49461

Mourtos's Problem Solving Skills: A View Based on Gender

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Abstract. Problem-solving skill is the ability to solve a problem using the right strategy or procedure. The research aims to analyze student's mastery of problem-solving evaluated according to gender. Based on Mourtos, Okamoto, & Rhee (2004), there is five problem solving skill indicators: defining the problem, explore the issues, planning the solution, implementing the plan, and evaluating. To obtain the problem-solving skills data using a test consisting of problem description. This research was denveloped through quantitative descriptive analysis to get data by employing a classroom test in grade X MIA II of Muhammadiyah 1 Pontianak, with 29 students of 13 men and 16 women participants. The research finding average results the examinationt of male students at 40 with and SD: 12,5. Whereas, on average, the female student problem-solving skill test result were 45 and SD: 8,8. The obtained percentage of the indicator was that of plan the solution 51,72%, implement the plan 49,14%, explore the problem 41,38%, evaluate 39,66%, and define the problem 32,76%. Based on finding, it can be conclused that problem solving skills in SMA Muhammadiyah 1 Pontianak is still low.

Keywords: problem solving, skills, gender

1. Introduction

The era of globalization has had quite a broad impact in various aspects of life, including education demands. Education is required to be able to produce human resources who have 21st century skills. The 21st century is a century that demands quality in all human efforts and results [1]. The 2013 curriculum, as stipulated in Permendikbud No. 36 of 2018, states that education to build the present and future must have intellectual abilities, communication skills, social attitudes, care, and participation to make a better national life [2]. According to the NEA (National Education Association), there are four skills needed to compete in the 21st century shortened to 4C, namely critical thinking and problem solving, communication, collaboration, and creativity and innovation [3].

Based on the 4C skills that have been proposed by the NEA (National Education Association), one of them is critical thinking and problem-solving skills. Problem-solving skills are one of the learning process goals in terms of aspects of the 2013 curriculum contained in KI 2, namely social attitudes. Common problem-solving skills will result in low quality of human resources [4]. Empowerment of problem-solving skills in learning is expected so that students can compete in the era of globalization and take advantage of

technological advances properly [5]. The thought process in problem-solving requires skills to process and organize the information obtained to solve problems. Having problem-solving skills means that students are capable of critical, logical, and creative thinking [6].

The first step that students must take in solving problems is to identify and analyze the situation to determine the steps and strategies to be used [7]. Successful problem-solving consists of three components: skills, meta-skill (practical knowledge that can be used for various situations, including those that have never been experienced), and willingness. Each of these components can influence each other [8]. In this case, students can be oriented to communicate, share, and use information technology to solve complex problems in learning materials [9]. Problem-solving skills related to the real world can be applied to solve the issues and competition in the real world as well [4].

Problems arise when there is a difference between the initial conditions and the goal state, and there is no solution to solve the problem. The initial state is where the problem starts; the ultimate goal of solving the problem is finding a solution to the problem [10]. The well-structured problem-solving theory includes two crucial processes, namely (1) looking for an issue or problem space (problem-solving looking at the task environment) and (2) a problem-solving process that involves searching through the problem space. In essence, seeking a problem contains a problem-solving interpretation of the problem that will determine how easily the problem can be solved. Problem-solving takes the primary information and tries to understand the problem or relates it to the knowledge they have to solve it [11].

Problem-solving is a way or strategy to realize expectations following right and correct procedures [12]. Assessment of student skills in solving problems can be seen from students' skills in solving problems that involve certain content or concepts being taught [13]. Assessment to measure student problem solving was developed based on needs analysis data on preliminary research on existing estimates in the field, reviews of relevant research, reviews of government policies on national education orientation, and considering the 21st century's demands, especially in a lot of education—assessment problem-solving skills developed in the form of file description tests [14].

Problem-solving includes (1) solving uncommon types of problems, and (2) identifying and asking questions that clarify some views and produce better solutions [15]. Indicators of physical problem-solving skills are a reference that can be used to measure whether or not problem-solving skills are achieved in a material. Indicators of problem-solving skills consist of 5 needles: defining the problem, exploring the issues, planning the solutions, implementing the plans, and evaluating [16]. Problem-solving can be done through field investigations or experiments in the laboratory. Problems are solved through evidence gathering, analysis, and synthesis of findings. Through experimentation, students can gain knowledge through experience [17].

2. Method

The research method used is descriptive research with a quantitative approach. This study describes problem-solving skills based on indicators of Mourtos, Okamoto, & Rhee

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(2004) in terms of the gender of students. This research was conducted at SMA Muhammadiyah 1 Pontianak. The sampling technique used random sampling to obtain class X MIA 2 as the sample of this study. The subjects of this study were 29 students consisting of 13 male students and 16 female students. The research instrument used was the essay test questions to obtain data on students' problem-solving skills. The essay test consists of 5 questions based on five indicators from Mourtos, Okamoto, & Rhee (2004). The data collection technique used by the researcher was a written test and documentation of the results. The test result data obtained will be analyzed based on the scoring guidelines that have been made. Furthermore, the average test score, standard deviation, and the percentage of each indicator of problem-solving skills in gender were calculated.
Problem solving skills test scores:

$$\text{Score} : \frac{Correct\ answers\ scores}{maximum\ score} X\ 100$$

Average problem solving skills test scores:

$$\text{Average} : \frac{value\ amount}{how\ much\ data}$$

The standard deviation of the test means:

$$s = \left(\frac{n \sum_{i=1}^{n} x_i^2 - (\sum_{i=1}^{n} x_1)^2}{n(n-1)} \right)^{1/2}$$

Information:
s^2 : variant
s : standard deviation
x_i : score x i-th
$\bar{x}$ = average
n = sample size

Percentage of each indicator:

$$\text{Average} : \frac{Scoring\ numbers\ for\ entire\ all\ student}{Maximum\ score\ in\ all\ students} \text{ x } 100\%$$

Furthermore, the percentage of each indicator of problem-solving skills will qualify into four categories, namely high, medium, low, and very low (pass/fail), based on the assessment guidelines made [18] in table 1.

Table 1. Percentage Qualification foe Each Indicator

Percentage	Qualification
$t > 75\%$	High
$50\% < t \leq 75\%$	Middle
$25\% < t \leq 50\%$	Low
$t \leq 25\%$	Pass/Fail

Information: t = percentage of each indicator

3. Results and Discussion

3.1. All Student Problem Solving Skills

Five indicators of problem-solving skills are used: defining problems, examining problems, planning solutions, implementing plans that have been made, and evaluating. In the first indicator, namely exploring the problem, it is expected that students can

mention facts related to the question, determine the concept or category, determine information/data related to the problem given, and determine the details of the problem (time, place, actor). In the second indicator, namely examining the problem, it is hoped that students can identify the root of the problem, examine the reciprocal relationship (cause-and-effect) of a given situation, check the severity of the problem, and limit the solutions that have been made to solve related issues. In the third indicator, namely planning solutions, it is expected that students can develop problem-solving plans based on the root of the problem, map sub-problems, and sub-solutions, and choose theories, principles, and approaches to solve related issues. In the fourth indicator, namely implementing the plan made, it is hoped that students can list the problems to be solved, sort the work steps related to the solutions that have been made, and determine who needs to be contacted to get information about implementing the solution. In the fifth indicator, namely evaluating, it is hoped that students can check the resolutions' feasibility, make assumptions regarding the answers made, estimate the results to be obtained through the explanations that have been created.

Students used the measurement of student's problem-solving skills in essay test questions consisting of 5 items based on the indicators put forward by Mourtos. From the student score data, it was obtained that the average score for the problem-solving skills of all students was 42.93, with a standard deviation of 10.73. This value indicates that students' problem-solving skills are still low. The percentage of each indicator of problem-solving skills in students is presented in table 2.

Table 2. Qualifications of Problem Solving Skills for All Students

No.	Indicator	Percentage	Qualification
1.	Defining the problem	32,76%	Low
2.	Explore the issues	41,38%	Low
3.	Planning the solution	51,72%	Middle
4.	Implementing the plan	49,14%	Low
5.	Evaluating	39,66%	Low

Defining the problem is the initial stage in issue solving steps based on the Mourtus theory. At this stage, students are asked to find several problems in the discourse. Based on table 2, the percentage of the first indicator is 32.76% with low qualifications. Among other indicators, the hand defining the problem is the indicator with the lowest rate. This is because students are not used to finding issues in discourse independently. Explore the issues is the second stage after defining the problem indicator. Based on table 2, it is found that the percentage increase to 41.38%, but it is still in low qualification. This means that students have begun to identify the root of the problem in a discourse. After the indicators explore the issues, it is continued with the planning the solution indicator. Among other indicators, the planning the solution indicator is the highest indicator, with a percentage of 51.72%, which can be qualified as a middle. Most students have understood the problem and can develop a plan to solve the issues found. This is in line with the opinion [19], which states that a solution can be sought if there is primary and mental knowledge underlying the problem-solving process in the problem-solving process. The next indicator is implementing the plan. In this indicator, students carry out projects according

to the concepts that have been made and are written into a chart to prove the problem assumptions that have been created. Based on table 2, implementing the plan has decreased in percentage compared to the previous hand to 49.14% with low qualifications. This means that many students are still not following the concept to carry out the plans that have been made. This is in line with a previous study conducted by [20], where the planning the solution indicator showed an average ability of 71% while the hand of implementing the plan decreased to 60%. The last arrow in the problem-solving step, according to Muertos, is evaluating. In this indicator, students use cognitive skills to re-analyze what has been done and assess the statements that have been put forward. The research results are shown in Table 2; the evaluating indicator has decreased from the previous hand to 39.66% with low qualifications. This can mean that students are not strong enough in using logic to connect what has been obtained with the analyzed theory so that the solution applied can be accepted or not. Only hand 3 gets a middle qualification, while indicators 1, 2, 4, and 5 get low stuff. In general, students' problem-solving skills based on the Mourtos indicator are still short.

3.2. Student Problem Solving Skills Based on Gender

From the student score data, it was obtained that the average value of male students was 40, with a standard deviation of 12.5. Meanwhile, the average score for female students was 45, with a standard deviation of 8.8. The percentage of each indicator for male students is presented in table 3.

Table 3. Male Student Problem Solving Skills Qualifications

No.	Indicator	Percentage	Qualification
1.	Defining the problem	38,46%	Low
2.	Explore the issues	38,46%	Low
3.	Planning the solution	46,15%	Low
4.	Implementing the plan	44,23%	Low
5.	Evaluating	32,69%	Low

Based on table 3, it is known that the highest percentage obtained by male students is in indicator 3, namely, planning a solution of 46.15%, then hand 4 is implementing the plan that has been made of 44.23%. In hands 1 and 2, namely defining the problem and checking for questions, the same percentage is obtained at 38.46%. The lowest rate is found in indicator 5, namely evaluating at 32.69%. Overall the percentage of all indicators qualifying is low. These results indicate that male students' problem-solving skills are still short. The percentage of each indicator for female students is presented in table 4.

Table 4. Female Students Problem Solving Skills Qualifications

No.	Indicator	Percentage	Qualification
1.	Defining the problem	28,13%	Low
2.	Explore the issues	43,75%	Low
3.	Planning the solution	56,25%	Middle
4.	Implementing the plan	53,13%	Middle
5.	Evaluating	45,31%	Low

Based on table 4, it can be seen that the highest percentage of indicators obtained by female students is on hand 3, namely, planning a solution of 56.25%. Indicator 4

implements the plan made of 53.13%; indicator five is evaluating at 45.31%, hand 2 is checking for problems at 43.75%. The lowest percentage is found in indicator 1, which defines the problem at 28.13%. On indicators 3 and 4, the problem-solving skills are moderately qualified, while hands 1, 2, and 5 are poorly trained problem-solving skills.

A comparison between the problem-solving skills of female students and male students is shown in table 5.

Table 5. Comparison of Male And Female Students' Problem Solving Skills

No.	Indicator	Male		Female	
		Percentage	Qualification	Percentage	Qualification
1.	Defining the problem	38,46%	Low	28,13%	Low
2.	Explore the issues	38,46%	Low	43,75%	Low
3.	Planning the solution	46,15%	Low	56,25%	Middle
4.	Implementing the plan	44,23%	Low	53,13%	Middle
5.	Evaluating	32,69%	Low	45,31%	Low

In the first indicator, defining the problem, male students obtained a higher percentage than female students. Based on [21] research, male students' problem-solving ben female students s because male students were more thorough and more complete in determining issues. However, in the second to fifth indicators, female students received a higher percentage than male students. The research [22] stated that a few problem-solvents problem-solving skills problem-solving male students. According to [23], female students have more vocabulary, reading concentration is full o; readinganding and can use about 20,000 words per day while boys only have 7,000 words. This is in line with the opinion [24], which states that women can convey their views to others. According to [25], the difference in thinking between men and women is due to the brain structure and hormones' influence. The implications of these differences in structure occur in the way and style of doing things. Girls generally excel in language and writing while boys excel in mathematics.

4. Conclusion

Based on the discussion results, it can be concluded that there are Student problem-solving skills get the highest percentage on the third indicator, namely, planning the solution. Simultaneously, the lowest rate is found in the first indicator, namely defining the problem—existence differences in problem-solving skills between male students and female students. The problem-solving skills of female students are higher than male students.

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