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Analysis of Problem-Solving Abilities of Elementary School Students Through Problem-Based Learning Model Based on Self Confidence

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Abstract

The purposes of this study are to improve students problem-solving abilities and self-confidence in the problem-based learning model and to describe the ability of students to solve mathematical problems through a problem-based learning model regarding students' confidence. This research is a mixed methods research, with an embedded experimental model. Data collection techniques used tests of problem-solving skills, confidence questionnaires, interviews, observation, and documentation. Data analysis techniques using N-Gain, Correlation Pearson and Triangulation of qualitative data. The subject of research amounted to 67 students. The results showed that there was an increase in mathematical problem-solving abilities and students' self-confidence significantly. Students' confidence have N-Gain score of 0.40 was included in the medium category, meanwhile, the students' problem-solving abilities with N-Gain scores of 0.36 included in the medium category. Students with high confidence can understand the problem, develop a problem-solving plan, implement a problem-solving plan, and recheck the results of problem-solving well, students with confidence moderate can understand the problem, develop a plan good problem solving, but less able to recheck the results of problem-solving, students with low self-confidence can understand problems, develop plans for problem-solving well, but are less able to implement problem-solving plans and are unable to recheck results of problem-solving.

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INTRODUCTION

Mathematics plays an important role and provides opportunities for students to develop their problem-solving abilities that can be used in solving problems in everyday life. This is by Minister of Education and Culture Regulation No. 22 of 2006 concerning the Standard of Content in which are stated five objectives of mathematics subjects. One of the five objectives of the mathematics courses is that students can solve mathematical problems that include the ability to understand the problem, devised a mathematical model, finish the model and interpret the obtained solution. Therefore, it is essential for teachers to master the techniques of solving mathematics and help students learn to solve mathematical problems.

The ability to solve mathematical problems must also be possessed by every student, referring to Minister of Education and Culture Regulation No. 81A Year 2013 concerning the Implementation of the Curriculum. The Minister of Education and Culture explained that in order to truly understand and be able to apply knowledge, students need to be encouraged to work on solving problems, finding everything for themselves, and striving to realize their ideas. Polya (1973) describes the stages of students' problem-solving abilities, among others, (1) understanding the problem; (2) devising a plan; (3) Carrying out the plan, and (4) looking back.

Mathematics plays an important role in developing the human mind, carrying out strategies, systematic reasoning processes used in problem analysis, and problem-solving. This role helps students to be able to anticipate, plan, decide and solve every problem in their daily lives (Phonapichat, Wongwanich, and Sujiva, 2014). When students solve a problem, students can find the right solution to the problem in their way (Ali, Hukamdad, Akhter, and Khan, 2010; Arslan, 2010; Caballero, Blanco, and Guerrero, 2011; Ahghar, 2012). The choice of this solution for students could is different each other. The students still experience difficulties in completing the test geometry problem-solving ability.

Based on the results of interviews that have been conducted with Class IV teachers at SDN 3 Purwodadi, students feel difficulties when faced with problem-solving problems, especially geometry material on a sub-topic of the two-dimensional object. Wahyuningtyas, Yuniasih, Irawan, Susiswo (2018), and Suryanti (2012) said fourth-grade students had difficulties in understanding the material, especially in geometry material, namely that 2-D and 3-D geometrical object, most students still could not understand the strategies for solving mathematical problems given by the teacher. Novferma (2016) also argued that students who experience learning difficulties tend to have difficulty in solving problems. Therefore Sa'dijah, Rafiah, Gipayana, Qohar, Anwar. (2016) also mentions the importance for educators to know the level of creative mathematical thinking of students so that each student can develop his creativity optimally.

Based on the results of observations it can be seen that students' social attitudes are still low. In the learning process students lack confidence in working on problems, giving up easily, still depend on friends, and students seem passive to receive information from their teacher, and when given problems students are nervous and tense. Whereas according to Lintang, Masrukan, and Wardani (2017) problem solving requires an attitude of confidence to determine the steps in solving a problem. Adywibowo (2010) defines self-confidence as a person's belief in the ability possessed to display certain behaviors or to achieve certain targets. In without the confidence of students will hesitate in completing a problem, so the student will not be maximal in solving the problem. Yuanita (2011) states that students with high trust will be more successful and able to solve problems in mathematics. Then Fauziah, Maya, and Fitrianna (2018) stated that there was a significant relationship between self-confidence in students' problem-solving abilities.

The PBL model can be applied to overcoming problems that arise during the learning process. Through the PBL model students actively develop their abilities in solving problems faced through the learning process

implemented. According to Ellianawati, and Subali (2010), problem-based learning is a way to teach by exposing students to a problem so that it can be solved or completed. The results of the study indicate that the application of PBL stimulates students' problem-solving abilities and student learning outcomes. Ari, and Katranci (2014), Park, and Choi (2015), and Tarmizi, R. A., Tarmizi, M. A. A., Lojinin, and Mokhtar. (2010). found that PBL can facilitate students in learning problem solving and can improve students' problem-solving abilities.

Based on the background review that has been described, it is necessary to research with the title "Analysis of Problem-Solving Abilities of Elementary School Students Through Problem-Based Learning Model Based on Self Confidence."

METHODS

This study uses a combination method (Mixed Methods) with an experimental mixed method design. This design means that researchers add data collection, data analysis, and qualitative into experiment results. As in Figure 1, qualitative data can be added to the experiment either before the experiment begins, during the experiment, or after the experiment (or in all or some of them).

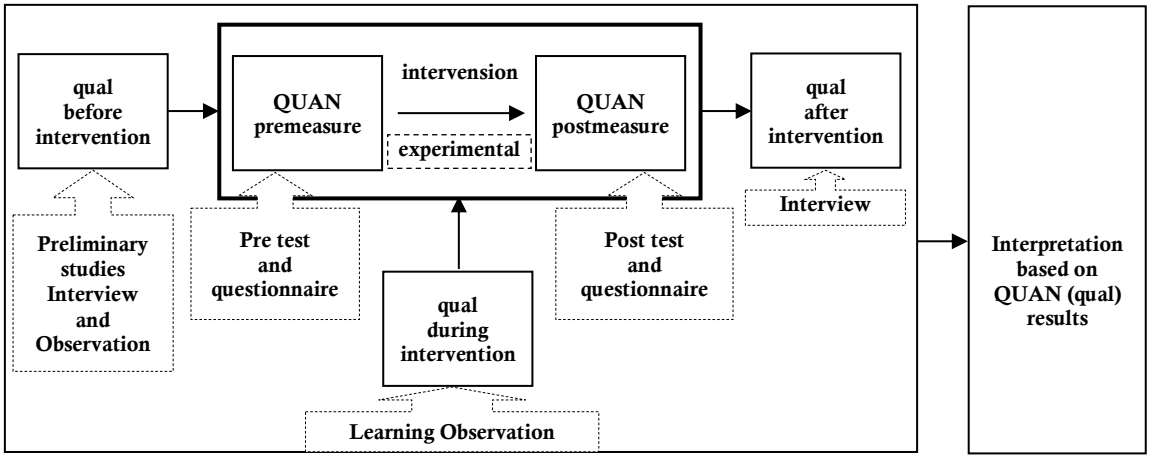

Figure 1. Diagram Embedded Experimental Model (Creswell, and Clark, 2007)

Based on Figure 1, in the first stage carried out by qualitative methods namely interviews and observations.

Furthermore, in the second stage, the intervention was conducted before the student intervention was given a questionnaire to determine the students' initial confidence level in 3 categories of high self-confidence, moderate self-confidence, and low self-confidence when the intervention was carried out learning observation. The third stage is conducting interviews with students in the category of high self-confidence, moderate self-confidence, and low self-confidence. The last stage is the interpretation of the results of all the quantitative and qualitative data.

The variable of this study consisted of independent variables namely the problem-based learning model, the dependent variable problem-solving ability, and intervening variables of student confidence. The population in this study were all fourth-grade elementary schools in Purwodadi Sub-District. Sample selection is made by purposive sampling technique with certain considerations. The total number of samples is 67 students.

The procedure of research is carried out through 3 stages, namely (1) planning; (2) implementation; (3) inference. The research hypothesis is that there is an increase in mathematical problem-solving skills and student confidence after learning through problem-based learning models. The data collection technique uses questionnaire sheets, problem-solving ability tests, observation sheets, and interview sheets for problem-solving skills. The indicator of self-

confidence used is composed of 5 indicators obtained from conclusions from several expert opinions. Then the problem-solving indicator uses four stages of Polya problem solving that are used to measure students' mathematical problem-solving abilities and for interview guidelines.

Analysis of data techniques uses quantitative and qualitative analysis techniques. Quantitative data analysis techniques include validity test using product moment correlation, reliability test using alpha Cronbach formula, normality test, and homogeneity test, and N-gain test. Qualitative data analysis includes data reduction (data reduction), presenting data (data display) and drawing conclusions. The data reduction stage in this study was started from analyzing the initial TKPM results of students, the results of filling in students' initial mathematics confidence questionnaire used to determine the research subject, and the results of interviews with research subjects according to the research objectives. The presentation of the data presents an overview of the overall results of the study regarding students mathematical problem-solving abilities regarding students' self-confidence. Data obtained from the results of questionnaires, observations, interviews, documentation are presented in the form of narratives, tables, charts, and so on. Data that has been reduced and presented is used by researchers to conclude.

RESULTS AND DISCUSSION

Student Problem Solving Ability

Data analysis of problem-solving students with learning mathematical problem-solving in the problem-based learning model using the N-Gain test. The following are the results of the N-Gain problem-solving test for students.

Table 1. N-Gain Test Results for Student Problem Solving Ability

Variable	Pre-test	Post-test	Gain	N-gain	Criteria
Problem solving ability	61.72	79.42	17.70	0.49	Moderate

Based on the results of the N-gain test in Table 1, it shows that there is a change in the average score from the pre-test to the post-test then the gain value and N-Gain appear. The average score of the problem-solving pre-test of students before implementing problem-solving learning with the problem-based learning model was 61.72, then increased in the post-test with an average of 79.42. Furthermore, students problem-solving gain is worth 17.70, while students' N-gain problem-solving scores show an increase in problem-solving for students with a value of 0.49 and are included in the medium category because of $0.30 \leq$ N-gain < 0.70.

Based on Figure 2, it appears that each indicator of problem-solving has increased. This means that students experience an increase in problem-solving in learning problem based learning models. The highest increase occurred in indicator four by 57%. This shows that students can re-examine the results of problem-solving only during the post-test because the results of the pre-test on indicator five have not been achieved. Based on the results of interviews with students when given the pre-test questions they confessed that they had difficulty seeing or checking their answers with proof, they were accustomed to just concluding the results of the answers.

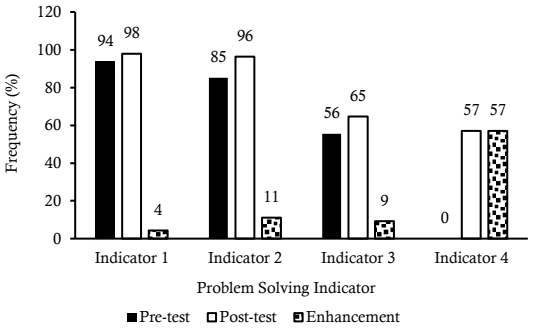

Figure 2. Graphics The ability of problem-solving Pre-test and Post-test

Based on Table 1 and Figure 2 above can be explained that the level indicator and question-solving the problem between the pre-test and post-test increase varied from highest to lowest.

This then it can be concluded that the ability of problem-solving students could rise after a given learning problem-solving related to the student's everyday environment on the learning model of problem-based learning.

Self Confidence

Analysis of student confidence data with learning mathematical problem-solving in the problem-based learning model using the N-Gain test. The following are the results of the Student's N-Gain Confidence test.

Table 2. N-Gain Test Results for Student Confidence

Variable	Early	End	Gain	N-gain	Criteria
Self confidence	49.51	66.42	16.91	0.40	Moderate

The results of the N-gain test in Table 2 show that there is a change in the average value from the pre-test to the post-test then the gain value and N-Gain appear. The average value of students' self-confidence pre-test before implementing problem-solving learning with a problem-based learning model is 49.51, then increasing in the post-test with an average of 66.42. Furthermore, the gain in student confidence is worth 16.91, while the N-gain value of students' self-confidence showed an increase in self-confidence of students with a value of 0.40 and included in the medium category because of $0.30 \leq$ N-gain < 0.70.

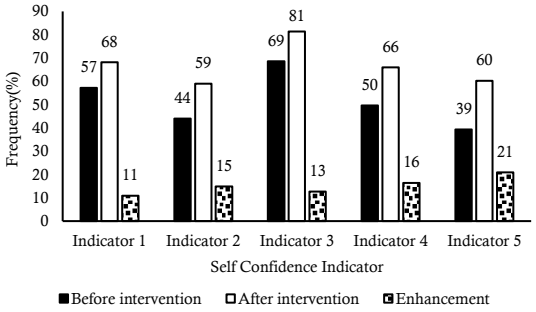

Figure 3. Graph of Self Confidence Before and After Intervention

Berdasarkan Based on Figure 3, it can be seen that every indicator of self-confidence has increased, meaning that students experience increased self-confidence in learning problem-solving skills in the problem-based learning model. The highest increase occurred in indicator five by 21%. The fifth indicator is a statement about asking the teacher about material that they do not understand. This shows an increase in students who dare to ask the teacher if there is material explained by the teacher not yet understood when the learning process of mathematical problem solving skills in the problem-based learning model.

Based on Table 2 and Figure 3 above, it can be explained that the level of indicators and each statement of students' self-confidence between before the intervention and after the intervention experienced varying increases from highest to lowest. It can be concluded that students' self-confidence can increase after being given learning to solve problems related to the daily environment of students in problem-based learning models.

Description of Problem Solving Ability Viewed from Student Confidence

The results of the data on the level of self-confidence of students given before problem-solving learning with the PBL model can be seen in Table 3.

Table 3. Results of Student self Confidence Scale Data

Category	The number of students	Percentage
High	18	26.87
Moderate	30	44.78
Low	19	28.36

The data in Table 3 can be seen that the number of students is 67, as many as 18 students are at a high level of confidence, 30 students are of a moderate level of self-confidence, and as many as 19 students are included in the low level of confidence.

In order to find out the description of problem-solving abilities viewed of self-confidence in problem-based learning. The

following is an example of math problems in learning with a problem-based learning model.

Problem No.5:
The flag of Indonesia is the flag of the Red and White. Red means courage, white means purity.
The Flag Red and White Flag is rectangular in size 2:3 in width. It is known that the length of the Red and White flag is 90 cm, then:
a. Count around the Red and White flag!
b. Drawing the Red and White flag!

The following are the answers to students who have high self-confidence. (Figure 4)

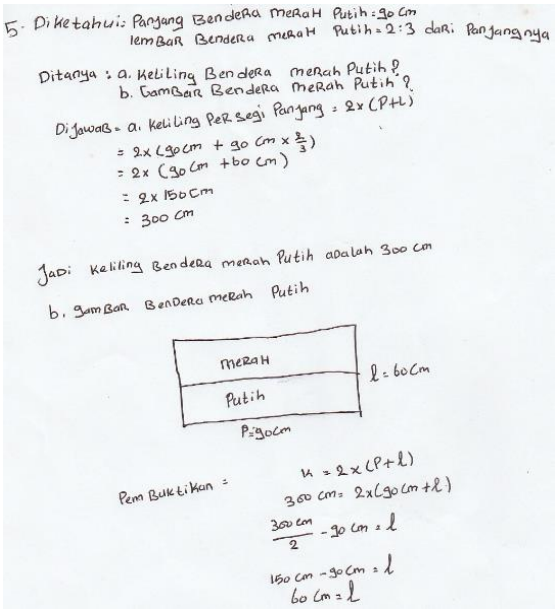

Figure 4. Student Answer Sheet 1

Based on the results of answers and interviews to students with high self-confidence it can be concluded that the subject can explain what information is known and asked from question number 5 correctly. When asked whether the formula is used in searching around a square and describing a red and white flag, the subject memorizes the formula around the rectangle and can answer correctly and can draw a red and white flag correctly complete with its size. The subject did not have difficulty in calculating the circumference of the rectangle and could conclude the results of problem-solving. The subject can also check/prove the answer correctly using the answer as a known problem. This is supported by the preparation of the subject in the face of the test. Subjects can prepare themselves by studying a few days before the test. The subject was also calm in doing the tests given by the teacher and did not look at a friend to ask for help. Then if the subject gets a score that is less than the minimum completeness criteria (KKM), the subject remains enthusiastic in learning to get good grades.

The following are the answers to students who have moderate self-confidence. (Figure 5)

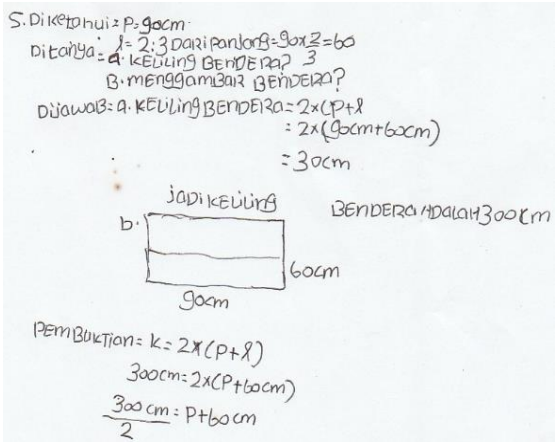

Figure 5. Student Answer Sheet 2

Based on the results of the answers and interviews with students who have moderate self-confidence, it can be concluded that the subject can explain what information is known and asked from question number 5 in a concise and precise manner. When asked whether the formula used in searching around a square and describing a red and white flag, the subject can write a formula around the rectangle and can answer correctly and can draw a red and white flag correctly complete with its size. The subject did not have difficulty in calculating the circumference of the rectangle and could conclude the results of problem-solving. However, the subjects were still unable to see/prove the answer correctly. This is supported by the preparation of the subject in the face of the test. Subjects can prepare themselves by studying before the test is held. The subject was also not calm in working on the tests given by the teacher; the subject was still staring at a friend because he was invited to chat. Then if the subject gets a value which is less than the KKM, the subject remains a passion for learning.

The following are the answers to students who have low self-confidence. (Figure 6)

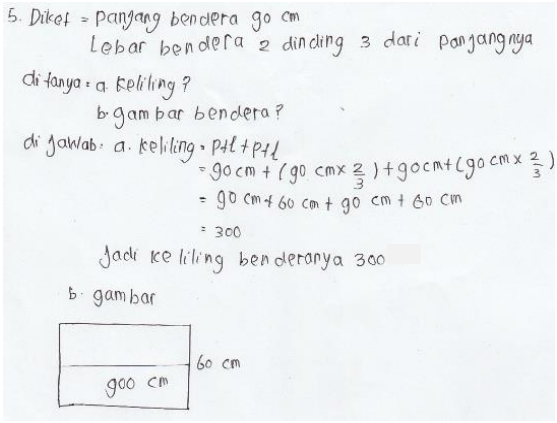

Figure 6. Student Answer Sheet 3

Based on the results of answers and interviews to students with low self-confidence it can be concluded that the subject can explain what information is known and asked from question number 5 correctly. When asked whether the formula is used in searching around a square and describing a red and white flag, the subject forgets the formula around the rectangle, but the subject answers in his way (p + l + p + l) and the subject can draw the red and white flag correctly but the wrong size. The subject did not have difficulty in calculating the circumference of the rectangle and could conclude the results of problem-solving, although it does not write down the length unit in the answer. The subject cannot prove the answer correctly. This is supported by the preparation of the subject in the face of the test. Subjects cannot prepare themselves by studying before the test is held. The subject was also not calm in doing the tests given by the teacher, still looking at a friend to ask for help so that he ran out of time and was in a hurry to do it. Then if the subject gets a score less than KKM, the subject still wants to learn to get good grades.

The results of the analysis of problem-solving abilities at the level of students' confidence based on the Polya stages can be briefly seen in Table 4.

Table 4. Results of Problem Solving Ability Judging from Self Confidence

Self-confidence	Stages of Problem Solving Ability			
	1	2	3	4
High	Able	Able	Able	Able
Moderate	Able	Able	Able	Less able
Low	Able	Able	Less Able	Unable

Based on the analysis of the results of the problem-solving ability test, confidence questionnaire, an interview, the six research subjects had different levels of confidence in working on tests of mathematical problem-solving abilities. In the first stage, understanding the problem of all subjects in the high, medium and low self-confidence categories can easily understand all information that is known and asked correctly. What is known in the questions of the six subjects writes in detail on the answer sheet, and so does the question asked?

The second stage in problem-solving skills is to develop a problem-solving plan. At this stage, all subjects in the high, medium and low self-confidence category can plan the problem solving very well. The research subject can write the formula based on the problem correctly, according to what was asked in the question. Only subjects low confidence use their methods.

The third stage in skills a problem solving is implementing a problem-solving plan. This stage requires that they be able to apply the plans they have made using the of two-dimensional object formula, or use their ideas. Subjects with high self-confidence and moderate self-confidence able to pass this stage well, the results of the answers written by the subject are very precise, the subject can write answers completely, be able to enter information into the formula, and be able to interpret the results obtained by making conclusions correctly and not hang answers to other friends. Subjects with moderate self-confidence have some questions they are not able to interpret the results obtained by making conclusions appropriately. Whereas subjects with low self-confidence find difficulties in passing this third stage, subjects are less sure of their answers, subjects are less able to enter information into formulas and are less able to write answers with correctly, subjects are unable to interpret the results obtained by making conclusions appropriately. The subject often depends on the answers of other friends, making the subject run out of time working on it.

The last step is to re-examine the results of problem-solving. In the subject of high self-confidence, they can re-examine the results of

problem-solving properly; the subject can re-examine the results of the answer by way of proof using the answers as known questions, they can use the time to check their answers. While the subjects who have moderate self-confidence, the majority are less able to check the results of the solution properly, the subject is less able to write proofs by using answers as known questions; the subject is only able to re-check the answers with just a few items and not all questions. Furthermore, the research subjects who have low self-confidence have not been able to pass this stage; the subject is unable to re-examine the results of problem-solving by using the answers as a known problem, they run out of time in working because they are still dependent on their friends. In line with the research of Anggraini, Siroj, and Indra (2010), students stated that they were still having difficulties in seeing/checking their answers.

Based on the analysis, it can be concluded that solving problems correctly must through the stages that need to be passed. Preparation in the face of the test also needs to be done by learning a few days before the test, being confident in one's abilities, and not relying on other friends in working on the test can avoid students from failing to work on problem-solving problems. According to Kusmaryono, and Basir (2006) states that students who have low self-confidence in learning are also low, afraid of being wrong, unsure of their abilities, and giving up easily, and ultimately achievement will also be low while students who have high self-confidence can realize and apply their ability to solve math problems well, and not easily discouraged.

CONCLUSION

Based on the results of the research and discussion that has been described, it can be concluded that there is an increase in mathematical problem-solving skills and students' confidence after learning the problem-based learning model. Analysis of problem-solving abilities regarding students' self-confidence obtained results that students with high confidence were able to complete all stages of problem-solving. Students with moderate self-confidence are also able to solve all stages of problem-solving but are still lacking in checking again. Students with low self-confidence can understand problems and develop a problem-solving plan well, but are unable to carry out the problem-solving plan, and are unable to look back on the results of problem-solving.

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