




The Effectiveness of Problem-Based Learning Model in Improving Higher Order Thinking Skills and Character of Elementary School Students

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Abstrak

Pencapaian kompetensi belajar IPA bagi anak-anak di Indonesia masih rendah. Pencapaian yang rendah ini diduga kuat karena siswa Indonesia belum terbiasa menghadapi soal-soal TIMSS dan PISA. Penelitian ini bertujuan untuk menganalisis keefektifan model pembelajaran berbasis masalah untuk meningkatkan higher order thinking skills (HOTS) dan karakteristik siswa SD. Penelitian ini adalah eksperimen semu menggunakan desain eksperimen pretestposttest non equivalent control group. Kelas eksperimen merupakan kelas dengan pembelajaran berbasis masalah, sedangkan kelas kontrol merupakan kelas dengan pembelajaran langsung. Populasi penelitian adalah siswa kelas V sekolah dasar. Sampel penelitian sebanyak 71 siswa yang berasal dari 5 sekolah, yang keseluruhan merupakan sekolah negeri. Sampel sekolah ditentukan dengan stratified random sampling dan kelas tiap sekolah ditentukan secara acak. Analisis data dilakukan secara kuantitatif, baik dengan deskriptif maupun inferensial. Hasil penelitian menunjukkan bahwa pembelajaran dengan model berbasis masalah lebih baik dibandingkan dengan pembelajaran langsung untuk meningkatkan HOTS; dan pembelajaran berbasis masalah efektif untuk meningkatkan ketekunan, tanggung jawab, kerja keras, kerjasama, kepedulian, dan toleransi.

Kata Kunci: Pembelajaran Berbasis Masalah, Keterampilan Berpikir Tingkat Tinggi, Karakter Siswa

Abstract

Achievement of science learning competence for children in Indonesia is still low. This low achievement is strongly suspected because Indonesian students are not used to dealing with TIMSS and PISA questions. This study aims to analyze the effectiveness of the problem-based learning model to improve higher order thinking skills (HOTS) and the characteristics of elementary students. This study was a quasi-experimental using a non-equivalent control group pretest-posttest experimental design. The experimental class is a class with problem-based learning, while the control class is a class with direct learning. The research population was fifth grade elementary school students. The research sample consisted of 71 students from 5 schools, all of which were public schools. The school sample was determined by stratified random sampling and the class of each school was determined randomly. Data analysis was carried out quantitatively, both descriptively and inferentially. The results of the study show that problem-based learning is better than direct learning to improve HOTS; and problem-based learning is effective for increasing perseverance, responsibility, hard work, cooperation, caring, and tolerance.

Keywords: Problem-Based Learning, Higher Order Thinking Skills, Student's Character

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1. INTRODUCTION

The government through the Ministry of Education and Culture has developed a curriculum to address future challenges and competencies that students must possess (Azizah, 2021; Krissandi & Rusmawan, 2015). Curriculum 2013 (K-13) is a curriculum that can produce Indonesian people who are productive, creative, innovative, and affective through strengthening integrated attitudes, skills, and knowledge (Fernandes, 2019; Suwandayani, 2018). The reasons for curriculum development are based on future challenges and competencies for students. The intended challenges are: (1) globalization (WTO, ASEAN

community, APEC, CAFTA), (2) environmental issues, (3) advances in information technology, (4) advances in science and technology, (5) knowledge-based economy, (6) the revival of the creative and cultural industries, (7) the shift in world economic power, (8) the influence and impact of technology, (9) quality, investment and transformation in the education sector, and (10) TIMSS and PISA materials (Antara & Dewantara, 2022; Pribadi et al., 2015). Meanwhile, future competencies that are intended are: (1) communication skills, (2) clear and critical thinking skills, (3) the ability to consider the moral aspect of a problem, (4) the ability to be a responsible citizen, (5) the ability to try to understand and tolerate different views, (6) the ability to live in a globalized society, (7) have a broad interest in life, (8) have a readiness to work, (9) have intelligence according to their talents/interests, and (10) have a sense of responsibility towards the environment (Jayadi et al., 2020; Zubaidah, 2019).

In its implementation at the education unit level, K-13 has undergone a revision process from 2016, 2017, and 2018. In spirit and concept, the curriculum 2013 is ideal enough to accommodate all future challenges. However, the data shows that the achievement of science/science learning competencies for children in Indonesia is still low, referring to the 2018 PISA results based on the OECD, the score for science from the 2018 test results was 396. This value has decreased compared to the 2015 test, where our science score got a score of 403 (Hewi & Shaleh, 2020; OECD, 2018). The decline in the PISA score is indeed a cause for concern. When compared to the international average, Indonesia has a considerable distance. Science on an international average is at 489. In addition, the achievements of Indonesian children in the field of science (IPA) in the Olympics on an international scale, including TIMSS (The Third International Mathematics and Science Study) Indonesia in 2015, stated that Indonesia's average score and ranking in science subjects was 500 and ranked 44th out of 49 countries.

This low achievement was strongly suspected because Indonesian students were not used to facing TIMSS and PISA questions. In principle, the TIMSS and PISA questions require students to not only remember facts and understand concepts, but students are required to reason and use mathematics in problem solving related to the skills of applying, analyzing, evaluating, and even creating using strategies that appropriate (Antara et al., 2022; Parmiti et al., 2022). The skills contained in TIMSS and PISA are referred to as Higher Order Thinking Skills (HOTS). Higher order thinking skills or HOTS is the ability to connect, manipulate and transform knowledge and experience already possessed to think critically and creatively in an effort to make decisions and solve problems in new situations. HOTS includes the ability to solve problems, critical thinking skills, creative thinking, the ability to argue, and the ability to make decisions. In Bloom's revised taxonomy, the HOTS feature is characterized by thinking that involves analysis, synthesis, and creation (Adesoji, 2018; Pujawan et al., 2022).

The curriculum 2013, besides promoting the importance of facilitating higher-order thinking skills, it also wants learning to develop character values (Bialik et al., 2015; Karta et al., 2022). This aims to create a balance between intellectual abilities and character. Character is a way of thinking and behaving that characterizes each individual to live and work together within the scope of family, community, nation and state. Individuals with good character are individuals who can make decisions and are ready to take responsibility for any consequences of the decisions they make (Pitaloka et al., 2021; Reza, 2014). In the 2013 curriculum, 18 character values were identified, namely: honesty, tolerance, discipline, hard work, creative, independent, democratic, curiosity, national spirit, love for the homeland, respect for achievement, friendly/communicative, peace-loving, fond of reading, care for the environment, social care, responsibility, and religion (Labudasari & Rochmah, 2019; Rubei, 2016). In 2017 the Ministry of Education and Culture of the Republic of Indonesia created

the PPK (Strengthening Character Education) Movement, which summarizes the 18 characters in five main character values that are interrelated in forming a value network that needs to be developed as a priority, namely: religious, nationalist, independent values, mutual cooperation, and integrity (Agung, 2017; Surawati & Suasthi, 2019). The strategies that can be used to develop character education include exemplary, intervention, habituation that is carried out consistently, and reinforcement.

Based on this description, a learning model is needed to support the implementation of learning that includes character education as well as being oriented to HOTS. One of the recommended learning models is problem based learning (PBL) (Kumullah et al., 2018; Pucangan et al., 2018). Problem Based Learning is learning that uses real everyday (authentic) problems that are open-ended to be solved by students in order to develop thinking skills, problem solving skills, social skills, skills for independent learning, and build or acquire new knowledge (Maskur et al., 2020; Pu et al., 2019). The selection of the real problem is carried out based on consideration of its suitability with the achievement of basic competencies (Ersoy & Başer, 2014; Triwahyuningtyas et al., 2020). If it is associated with character education, the existence of investigations and discoveries in PBL can facilitate students to increase their hard work, perseverance, discipline, and self-confidence, while collaboration and arrangements for the division of tasks among students can train students to care, work together, be responsible, and have tolerance for each other. Thus the implementation of PBL can improve HOTS as well as student character.

The previous studies showed that students' thinking skills increased in terms of critical and creative thinking skills (Blackburn, 2015; Hussin et al., 2018). In addition, problem-based learning will provide students with longer knowledge than traditional learning, even though less is learned (Atika et al., 2020; Maskur et al., 2020). In line with these results, problem-based learning becomes easier to implement in learning, and increases student learning motivation, improves student achievement and attitudes in understanding concepts and reduce misconceptions, improve students' understanding and skills to be applied in real life. Based on this, this study aims to describe the effectiveness of problem-based learning to improve HOTS and student characteristics.

2. METHODS

This research was a quasi-experimental study using a non-equivalent pre-posttest control group design. The research subjects were 71 fifth grade students from 6 public elementary schools in Marga Sub-district, Tabanan, Bali. Schools were selected using stratified random sampling, concerning to the result of the National Examination achievement and school status. The class from each school was chosen randomly. In this research, the experimental group was given a problem-based learning treatment, and the control group was given a direct (expository) learning treatment. Each group consists of 5 classes. The ability to solve HOTS problems that could be measured using an instrument in the form of a test that has proven validity and has good reliability. In addition, students were also asked to do a self-assessment related to the development of their character which includes; perseverance, responsibility, hard work, cooperation, caring, and tolerance. In this study, educators in the experimental class carried out learning using PBL, with the syntax (1) formulating a problem (the teacher guided students to determine the problem to be solved in the learning process, even though the teacher had actually determined the problem), (2) analyzed the problem by reviewing the problem), problems critically from various points of view, (3) formulating hypotheses by formulating various possible solutions according to their knowledge, (4) collecting data by means of students finding and describing various information needed to solve problems, (5) testing hypotheses using formulate and draw

conclusions in accordance with the acceptance and rejection of the proposed hypothesis, (6) formulate problem solving recommendations according to the formulation of the results of hypothesis testing, and (7) formulate conclusions. Data analysis was carried out quantitatively, both descriptively and inferentially. Descriptive analysis was used to describe changes in the results of the pretest and posttest and also the development of students' character. The results of the analysis were presented with a graph. Inferential analysis was used to compare the achievement of students' high order thinking skills scores in the experimental class compared to the control class, to be generalized to the population.

3. RESULTS AND DISCUSSION

Result

Using descriptive analysis, it was found that in the experimental group, the students' initial higher order thinking skills (HOTS) was slightly higher than the control group, as well as in the post-test, as shown in [Figure 1](#). In order to know both comparisons, the information is presented using the gain value, in [Figure 2](#).

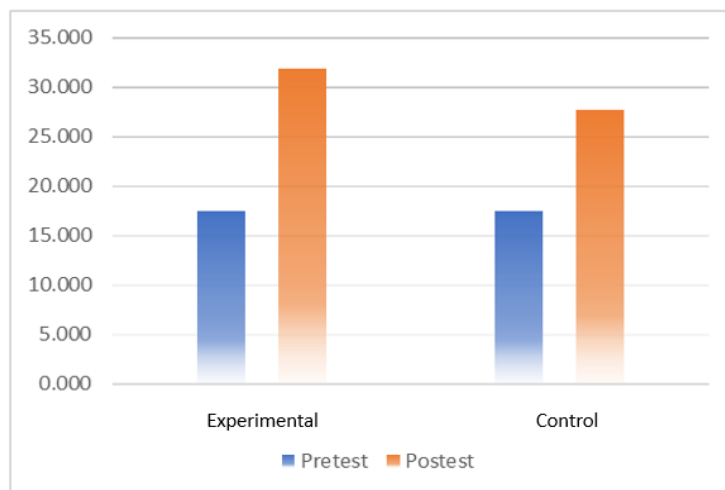


Figure 1. Pre-Post Results of Experimental and Control Group

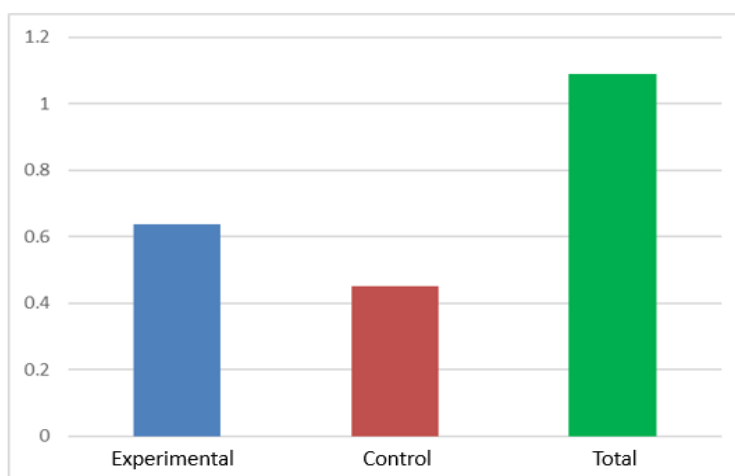


Figure 2. Gain of Experimental and Control Group

These results indicated that learning with problem-based learning produces better achievement in HOTS compared to use direct learning. In order to prove that there is a significant difference between the experimental group and the control group, a different test was carried out for the gain value. But first, the assumption test was carried out, namely the data is normally distributed and the variance is homogeneous. The normality test was carried out with the Kolmogorov Smirnov test, which resulted in a value of 0.071 with a p-value of 0.080 and the results are presented in [Table 1](#).

Table 1. Normality Assumption Test

Statistics		N Gain
	N	142
Normal Parameters ^{a,b}	Mean	0.545
	Std. Deviation	0.206
Most Extreme Differences	Absolute	0.071
	Positive	0.067
	Negative	-0.071
	Test Statistic	0.071
	Asymp. Sig. (2-tailed)	0.080

Table 2. Test of Assumptions of Homogeneity of Variance and t-Test

Statistics	Levene's Test for Equality of Variances		t-test for Equality of Means			
	F	Sig.	t	Df	Sig. (2-tailed)	
N_Gain	Equal variances assumed	0.230	0.632	6.041	140	0.000
	Equal variances not assumed			6.041	139.840	0.000

The results of the analysis showed that the data was normally distributed. The next assumption that is proven was the assumption of homogeneity of variance between the experimental group and the control group. The assumption of homogeneity of variance was proven by Levene's test, which produces an F value of 0.230 with a p-value of 0.632, whose full results are presented in [Table 2](#). These results indicated that the assumption of similarity of variance of the 2 populations, namely the experimental group and the control group, is fulfilled. Based on [Table 2](#), the results of the t-test were also obtained, to test the hypothesis that the mean of higher order thinking skills in the experimental group was higher than the control group. Because $2 \text{ Sig} = 0.0 < 0.05$ was obtained, it can be concluded that the mean of higher order thinking skills in the experimental group was higher than the control group. This shows that problem-based learning is better than direct learning to improve HOTS.

Besides aiming to increase HOTS, PBL is also oriented to improve students' character. By paying attention to the steps and characteristics of PBL, the characters to be trained include perseverance, responsibility, hard work, cooperation, caring, tolerance, and self-confidence. This character improvement is indicated by the increasing frequency of students' self-assessments in the good and very good categories, and the decreasing frequency of students' self-assessments in the less and sufficient categories. In detail, these results are presented in [Table 3](#). Each character that was trained is presented with a bar chart. The results of the self-assessment of persistence are presented in [Figure 3](#).

Table 3. Character Assessment Results Before and After Using PBL

Aspects	Before (%)				After (%)			
	Less	Enough	Good	Very Good	Less	Enough	Good	Very Good
Perseverance	45.07	19.72	25.35	9.86	0	0	42.25	57.75
Responsibility	43.66	19.72	21.13	15.49	0	0	29.58	70.42
Hard Work	39.44	19.72	26.76	14.08	0	0	33.80	66.20
Cooperation	43.66	22.54	25.35	8.45	0	0	35.21	64.79
Caring	46.48	14.08	23.94	15.49	0	0	39.44	60.56
Tolerance	54.93	8.45	29.58	7.04	0	0	29.58	70.42
Self-Confidence	46.48	15.49	33.80	4.23	0	0	39.44	60.56

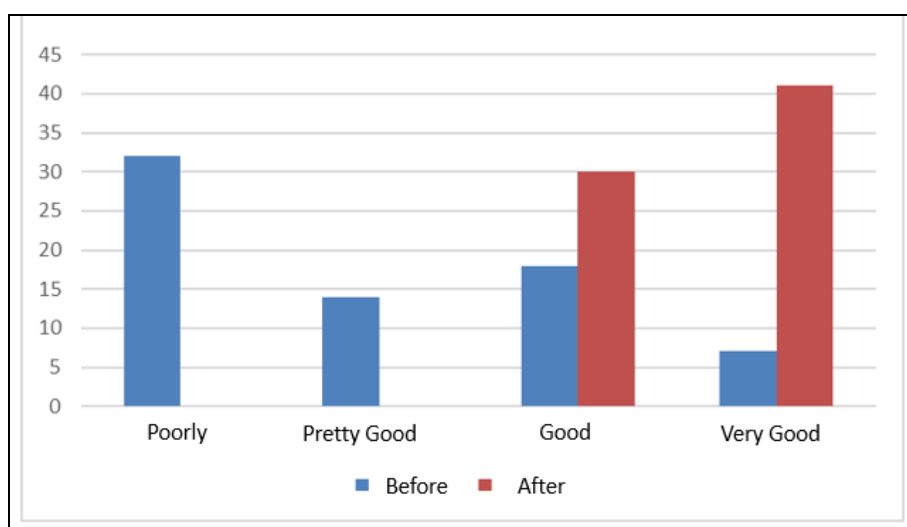


Figure 3. Increasing Perseverance Based on Self-Assessment

Based on Figure 3, the frequency of students who have a diligent attitude in the "Good" and "Very Good" categories before treatment has increased after being given treatment. The frequency of students who had a diligent attitude in the "Good" category before treatment amounted to 18 students increased to 30 students after being treated, meaning that there was an increase in the frequency of 12 students. The same thing happened in the "Very Good" category where at first the frequency of students who had a diligent attitude in the "Very Good" category was only 7 students increased to 41 students after being given treatment, meaning that there was an increase in the frequency of 24 students. The frequency of students who have a diligent attitude in the "Less" and "Enough" categories before treatment decreased after being given treatment. In the "Less" category the frequency of students before treatment was 32 students, then after treatment decreased to none, meaning that there was a decrease in the frequency of 32 students. While in the "Enough" category, the frequency of students before treatment as many as 14 students decreased to none after being given treatment, meaning that there was a decrease in the frequency of 14 students. The description of this data shows that the provision of treatment in the form of PBL in learning is effective in increasing students' diligent attitude.

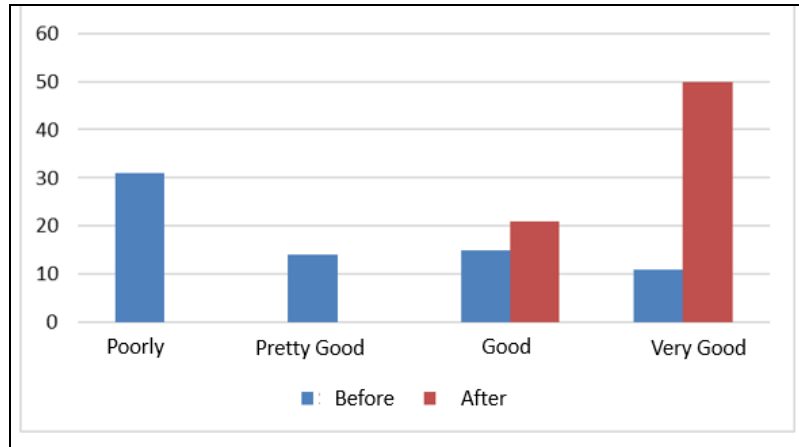


Figure 4. Increasing Attitude of Responsibility Based on Self-Assessment

Based on Figure 4, the frequency of students who have a responsible attitude in the "Good" and "Very Good" categories before treatment has increased after being given treatment. The frequency of students who had responsibility in the "Good" category before treatment amounted to 15 students increased to 21 students after being given treatment, meaning that there was an increase in the frequency of 6 students. The same thing happened in the "Very Good" category where at first the frequency of students who had responsibility in the "Very Good" category was only 11 students, after being given treatment, it increased to 50 students, meaning that there was an increase in the frequency of 39 students. The frequency of students who have responsibilities in the "Less" and "Enough" categories before treatment tends to decrease after being given treatment. Before treatment there were 31 students whose attitude of responsibility was still in the "Less" category, then after being given treatment there were no more students who had responsibilities in the "Less" category, meaning that there was a decrease in the frequency of 31 students. While in the "Enough" category, the frequency of students before treatment as many as 14 students decreased to no more students in the "enough" category after being given treatment, meaning that there was a decrease in the frequency of 14 students. This data description shows that the provision of treatment in the form of PBL in learning is effective in increasing student responsibility.

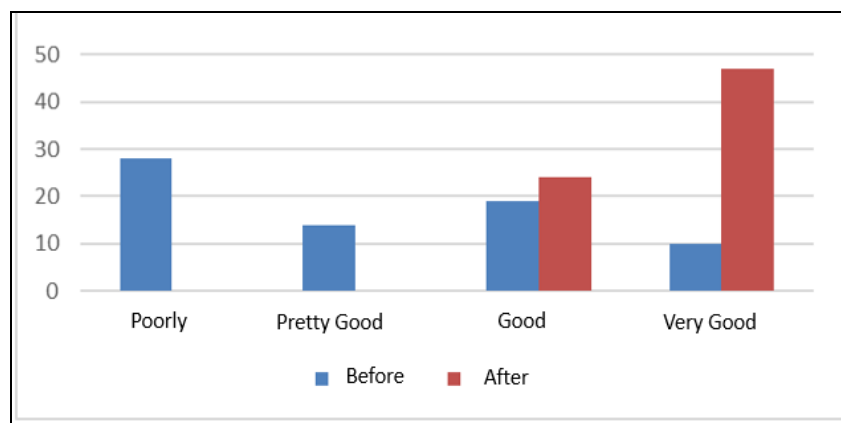


Figure 5. Increasing Hard Work Attitude Based on Self-Assessment

Figure 5 shows the frequency of students who have a hard-working attitude in the "Good" and "Very Good" categories before treatment has increased after being given treatment. The frequency of students who had a hard-working attitude in the "Good" category

before treatment amounted to 19 students increased to 24 students after being treated, meaning that there was an increase in the frequency of 5 students. The same thing happened in the "Very Good" category where at first the frequency of students who had a hard-working attitude in the "Very Good" category was only 10 students, after being given treatment increased to 47 students, meaning that there was an increase in the frequency of 37 students. The frequency of students who have a hard-working attitude in the "Less" and "Enough" categories before treatment tends to decrease after being given treatment. Before treatment there were still 28 students whose hard work attitude was still in the "Less" category, then after being given treatment there were no more students who had a hard-working attitude in the "Less" category, meaning that there was a decrease in the frequency of 28 students. While in the "Enough" category, the frequency of students before treatment was 14 students, then there were no more students who had a hard-working attitude in the "Enough" category after being given treatment, meaning that there was a decrease in the frequency of 14 students. The description of this data shows that the provision of treatment in the form of PBL in learning a is effective for improving students' hard-working attitude.

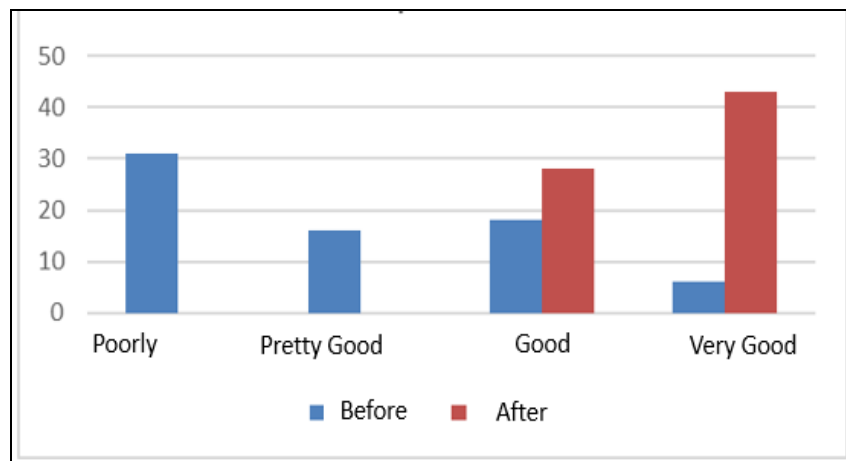


Figure 6. Increasing Attitude of Cooperation Based on Self-Assessment

In [Figure 6](#), the frequency of students who have a cooperative attitude in the "Good" category has increased after being given treatment, and in the "Very Good" category the frequency before treatment has increased significantly after being given treatment. The frequency of students who have a cooperative attitude in the "Good" category which initially amounted to 18 students, after being given treatment increased to 25 students, meaning that there was an increase in the frequency of 7 students. The cooperative attitude of students in the "Very Good" category where initially the frequency of students who had a cooperative attitude in the "Very Good" category was only 6 students, increased to 46 students after being treated, meaning that there was an increase in the frequency of 40 students. The frequency of students who have a cooperative attitude in the "Less" and "Enough" categories before treatment tends to decrease after being given treatment. Before treatment there were still 30 students whose cooperative attitude was still in the "Less" category, then after being given treatment there was a significant decrease to 0 students who had a cooperative attitude in the "Less" category. While in the "Enough" category, the frequency of students before treatment as many as 16 students decreased to 36 students after being given treatment, meaning that there was a decrease in the frequency to 0 students. Overall, the treatment in the form of PBL in learning is effective to increase student cooperation.

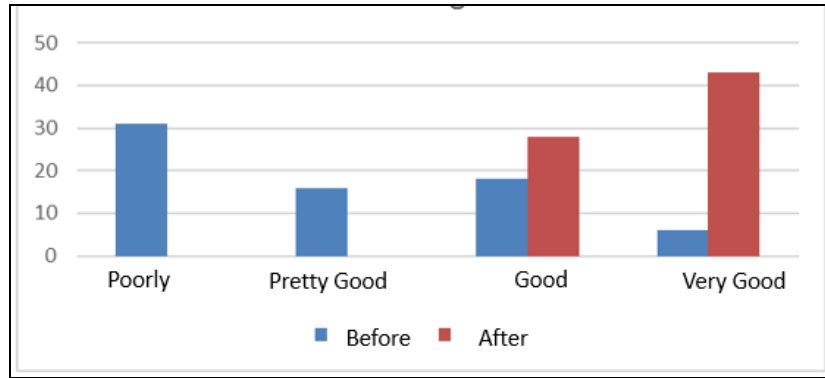


Figure 7. Increasing Caring Attitude Based on Self-Assessment

Figure 7 shows the frequency of students who have a caring attitude in the "Good" and "Very Good" categories before treatment has increased after being given treatment. The frequency of students who had a caring attitude in the "Good" category before treatment amounted to 17 students increased to 28 students after being treated, meaning that there was an increase in the frequency of 11 students. The same thing happened in the "Very Good" category where at first the frequency of students who had a caring attitude in the "Very Good" category was only 11 students, after being given treatment, it increased to 43 students, meaning that there was an increase in the frequency of 32 students. The frequency of students who have a caring attitude in the "Less" and "Enough" categories before treatment tends to decrease after being given treatment. Before treatment there were 33 students whose caring attitude was still in the "Less" category, then after being given treatment there were no more students who had a hard-working attitude in the "Less" category, meaning that there was a significant decrease in the frequency of 33 students. While in the "Enough" category, the frequency of students before treatment was quite high, namely as many as 10 students, then decreased until there were no more "enough" students after being given treatment, meaning that there was a decrease in the frequency of 10 students. The description of this data shows that the provision of treatment in the form of PBL in mathematics learning is effective in increasing students' hard work attitudes.

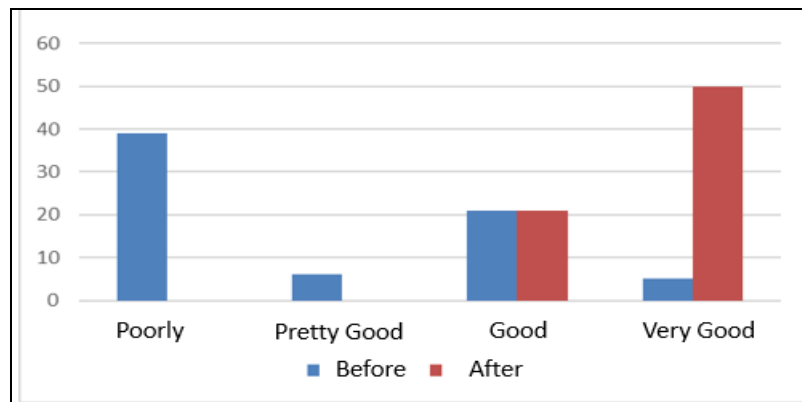


Figure 8. Increasing Tolerance Based on Self-Assessment

Figure 8 shows the frequency of students who have tolerance in the "Good" category before and after the treatment still does not change, as many as 21 students. In the category of "Very Good" there was a significant increase after being given treatment. The frequency of students who have tolerance in the "Very Good" category before treatment amounted to 5 students increased to 50 students after being given treatment, meaning that there was an

increase in the frequency of 45 students. The frequency of students who have tolerance in the "Less" and "Enough" categories before treatment tends to decrease after being given treatment. Before treatment there were 39 students whose tolerance was still in the "Less" category, then after being given treatment there were no more students who had tolerance in the "Less" category, meaning that there was a decrease in the frequency of 39 students. While in the "Enough" category, the frequency of students before treatment was 6 students, then there were no more students in the "Enough" category after being given treatment, meaning that there was a decrease in the frequency of 6 students. This data description shows that the provision of treatment in the form of PBL in learning is effective in increasing student tolerance.

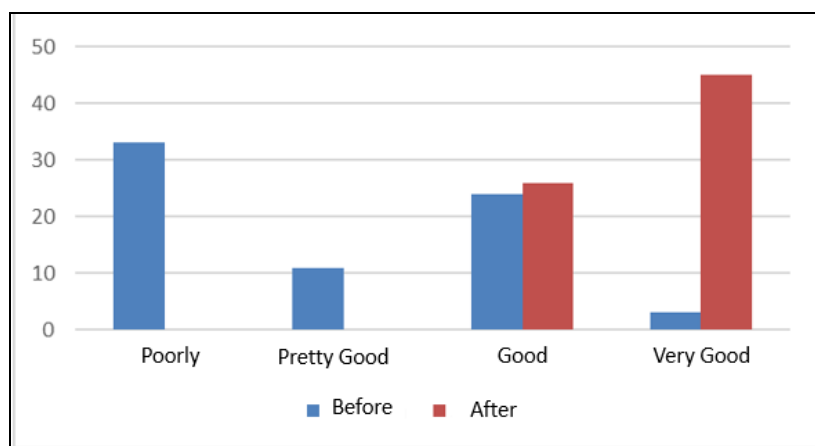


Figure 9. Increasing Self-Confidence Based on Self-Assessment

Figure 9 shows the frequency of students who have confidence in the "Very Good" category before treatment experienced a significant increase after being given treatment. The frequency of students who have tolerance in the "Very Good" category before treatment amounted to 3 students increased to 43 students after being given treatment, meaning that there was an increase in the frequency of 40 students. the increase occurred in the "Good" category where at first the frequency of students who had confidence in the "Good" category was only 24 students, after being given treatment increased to 28 students, meaning that there was an increase in the frequency of 4 students. The frequency of students who have confidence in the "Less" and "Enough" categories before treatment tends to decrease after being given treatment. Before treatment there were still 33 students whose self-confidence was still in the "Less" category, then after being given treatment there were no more students who had confidence in the "Less" category, meaning that there was a decrease in the frequency of 33 students. While in the "Enough" category, the frequency of students before treatment was quite high, namely as many as 11 students, then there were no more students in the "Enough" category after being given treatment, meaning that there was a decrease in the frequency of 11 students. The description of this data shows that the provision of treatment in the form of PBL in learning is effective in increasing students' self-confidence.

Discussions

The results showed that the application of PBL tools was effective in increasing students' HOTS in learning. These results are in line with the opinion who stated that PBL can increase students' HOTS (Hasyim & Eldiana, 2020; Hidayah & Pujiastuti, 2016). The application of PBL tools is also effective for improving student character which includes perseverance, responsibility, hard work, cooperation, caring, tolerance, and self-confidence.

This shows that the intervention. This is in line with the opinion, that one strategy to develop character education is through intervention (Alrahlah, 2016; De Witte & Rogge, 2016).

The application of the PBL learning model is carried out by forming heterogeneous groups. Each group consists of students with high, medium and low abilities. This group activity encourages students to share tasks in solving the problems posed (Aslan, 2021; Kusumatuty et al., 2018). Each student is given the responsibility to complete their respective assignments. Students who have high academic abilities will help other students in designing solutions to solve problems. If there is a difference of opinion students will discuss it and find the best solution. This is in accordance with the opinion that PBL requires students to collaborate and organize assignments between students (Misla & Mawardi, 2020; Syakur et al., 2020). By getting used to students doing discussion activities, they can form an attitude of responsibility, care and tolerance for students. This is supported by the opinion that one strategy to develop character is through habituation consistently (Julia & Ati, 2019; Rochmawati, 2018). This is what encourages each student to play an active role during the learning process.

The application of the PBL learning model could make students more active. This is because in PBL students were involved in formulating problems, analyzing problems, formulating hypotheses, and concluding solutions to these problems (Nargundkar, 2014; Pamungkas et al., 2018). Students feel happy with the delivery of material using the PBL learning model, because the delivery of material begins with the submission of a problem (Maskur et al., 2020; Yusof et al., 2012) and the problem is a real problem that is close to students' daily lives (Kumar & Refaei, 2017; Suastra et al., 2019). This encourages students to be willing to ask questions when having trouble finding or analyzing problems. This process also makes students more confident. In some schools, the application of the PBL learning model is a relatively new thing. However, this learning model is quite influential for most students. The application of the PBL learning model can make students happy in participating in the learning process. This is evident when all students are active to work on the Worksheets given by the teacher.

4. CONCLUSION

Based on the results of the research and discussion, it was concluded that the use of problem-based learning tools is effective to improve HOTS and problem-based learning is better than direct learning to improve HOTS. In addition, the problem-based learning model is also effective for improving student character which includes perseverance, responsibility, hard work, cooperation, caring, and tolerance. There were several factors that cause the use of problem-based learning tools to be effective in improving HOTS and student character, including: (1) posing challenging problems in PBL increases students' motivation to learn; (2) the stages in PBL make students more active in learning activities; (3) the submission of contextual problems in the Worksheet makes students enthusiastic to solve them; (4) the application of PBL in learning motivates students to seek information through various sources; and (5) the existence of study groups in PBL makes student interaction in learning more dynamic. It was recommended for teachers to use PBL as an alternative method, model, or approach to improve students' HOTS in learning in elementary school. Given that there are still obstacles faced by teachers in implementing PBL, it is still necessary to conduct relevant research related to the difficulties of teachers implementing PBL. In addition, considering that there are still limited PBL tools that are oriented to improving HOTS and student character, it is necessary to develop similar tools in other materials.

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