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Improvıng Understandıng Of KPK And FPB Wıth Project Based Learnıng Model In Elementary School

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ABSTRACT
The background to this research is that students' understanding ability in calculating the KPK and FPB in mathematics learning is still low. In developing the ability to count and solve formulas, learning mathematics in elementary schools also aims to advance the overall intellectual growth of students. The aim of this research is to support educators in helping students understand mathematics learning in KPK and FPB material in elementary schools using the Project Based Learning model. The learning strategy that the instructor uses to convey the subject has a direct bearing on how well the students comprehend the KPK and FPB content. This study used quasi-experiments as part of its experimental design. A pretest and posttest description question is the tool utilized. 29 fourth-grade kids (N) from State Elementary School 2 Selo Boyolali served as the research subjects. The T test method was combined with the homogeneity test method and the data normalcy test for data analysis. The findings demonstrated how using the Project Based Learning model to teach KPK and FPB might enhance students' comprehension skills. The Project-Based Learning model can be a teaching model that can be used to improve students' understanding of KPK and FPB content in mathematics
***Keywords**: Mathematics, Understanding, Project Based Learning, KPK and FPB*

ABSTRAK
Penelitian ini dilatarbelakangi oleh kemampuan pemahaman siswa dalam menghitung KPK dan FPB dalam pembelajaran matematika masih rendah. Dalam mengembangkan kemampuan berhitung dan memecahkan rumus, pembelajaran matematika di sekolah dasar juga bertujuan untuk memajukan pertumbuhan intelektual siswa secara keseluruhan. Tujuan penelitian ini adalah untuk mendukung pendidik dalam membantu siswa memahami pembelajaran matematika pada materi KPK dan FPB di sekolah dasar dengan menggunakan model Project Based Learning. Strategi pembelajaran yang digunakan pengajar dalam menyampaikan materi berpengaruh langsung terhadap seberapa baik mahasiswa memahami materi KPK dan FPB. Penelitian ini menggunakan eksperimen semu sebagai bagian dari desain eksperimennya. Alat yang digunakan adalah soal deskripsi pretest dan posttest. Subyek penelitian adalah 29 anak kelas IV (N) SD Negeri 2 Selo Boyolali. Metode uji T dipadukan dengan metode uji homogenitas dan uji normalitas data untuk analisis data. Temuan ini menunjukkan bagaimana penggunaan model Pembelajaran Berbasis Proyek untuk mengajar KPK dan FPB dapat

meningkatkan keterampilan pemahaman siswa. Model Project Based Learning dapat menjadi salah satu model pembelajaran yang dapat digunakan untuk meningkatkan pemahaman siswa terhadap materi KPK dan FPB dalam matematika.
Kata Kunci: Matematika, Pemahaman, Project Based Learning, KPK dan FPB

INTRODUCTION

The purpose of teaching mathematics in primary schools is more than just helping children count and use formulas to solve mathematical problems, it is also directed at the overall intellectual development of students in addition to preparing students for various academic and professional activities that will be faced in this digital era. Mathematics can be defined as the study of numbers related to concepts, procedures, and reasoning in human thought (Hidayati et al. 2012). Mathematics is a science that does not just make students smart in counting but will shape the logic of thinking as based on the minds and reasoning of students (Hera and Sari 2015). In mathematics lessons students are educated to recognize, understand, and be skilled in using and applying mathematical concepts in various contexts.

The process of gaining comprehensive knowledge about something through experience is called understanding (Kholidah and Sujadi 2018). Students' understanding of the basic concepts of mathematics is an important part of the learning process of mathematics so that this needs to be emphasized by students in the teaching process. According to research conducted by (Fariana et al. 2022) stated that one of the causes of students' learning difficulties is their inability to understand the concepts taught in class by the teacher. This can be attributed to the weakness of traditional learning methods which are more passive. Traditional learning methods generally focus more on the explanation of the material to students and this method is less able to attract students' interest in the material presented in addition to not significantly increasing students' understanding and knowledge (Mustofa et al. 2023). To overcome this, learners need to strategize and innovate to improve the effectiveness of learning sessions. The position and role of the learner is very crucial in transforming the traditional passive learning process to active learning because the success or failure of students in learning is largely determined by the ability, creativity, and skills of the learner (Unaenah et al. 2020). Active learning can be achieved by integrating modern learning methods in learning sessions. Modern learning methods are more student-focused, and can increase students' knowledge and understanding of the material provided (Ika Suci Cahyani 2017). Therefore, learners need to implement learning methods that have the potential to help improve student understanding in the mathematics learning process.

One model that can be implemented in the process of learning mathematics is the Project Based Learning (PJBL) model. PJBL is an innovation in education that is thought to help students develop the knowledge and skills they need, including flexibility, self-assurance, communication skills, collaboration abilities, and the capacity to inspire change in oneself (Diana and Sukma 2021). This model is a form of learning model that produces work or projects in learning. This model is centered on students who are actively involved in projects and tasks and unlike traditional learning methods that focus more on memorization and isolated learning, the PJBL model emphasizes the application of knowledge to solve complex and real-

world-based problems (Faslia, Aswat, and Aminu 2023). According to research that has been conducted by (Sutarto et al. 2021), PJBL model is an activity where teachers and students can work together to develop and formulate learning activities. Among the advantages of this PJBL model is that this model can train students to think critically, increase student involvement in the learning process, and help students' long-term retention of the knowledge gained (Anggraini and Wulandari 2020). Based on previous studies, the project-based learning paradigm helps foster students' creative thinking capacity because it gives them the opportunity to develop their knowledge and produce original work (Pujiastuti et al. 2023). The project-based model gives students hands-on experience. They don't just listen to lectures or read material, but are actually involved in direct practical activities that require them to apply their knowledge. Students can develop real-life skills such as problem solving, teamwork, communication and creativity (Pradana et al. 2023).

In observations made by researchers at SD Negeri 2 Selo Boyolali, it was found that the ability of students' understanding in calculating KPK and FPB in learning mathematics, there are grade 4 students who consider the process of calculating the value of KPK is the same as FPB and vice versa such as factors, multiples, KPK, and FPB are often introduced simply, although not completely. For example, we often only use the idea or model of a factor tree (prime factorization) to get the value of KPK and FPB, and most students tend not to understand the determination of which number is the number of FPB and which number is the determination of KPK and there are some students who have not mastered the previous material such as the calculation of multiplication and division in the material of FPB and KPK.

By using the Project Based Learning model, the researcher intends to overcome learning challenges and provide students with a deeper understanding the principles of FPB and KPK. Thus, in the forth grade of State Elementary School 2 Selo Boyolali, the Project Based Learning model is a variable to improve students' mathematical ability knowledge on KPK and FPB materials. The use of a project-based learning approach in the classroom is expected to give students the tools they need to work in groups, solve problems, learn on their own, and acquire a variety of information. The novelty of this research lies in its focused application of the Project-Based Learning model to specifically improve the understanding of KPK and FPB in elementary school students. While the benefits of PBL in general mathematics education are well-documented, there is a gap in research explicitly targeting these fundamental concepts.

This research is very important to improve elementary students' understanding of KPK and FPB because this learning model combines practical, contextual and collaborative aspects which make abstract mathematical concepts easier to understand and apply. PjBL also increases students' motivation, engagement, and critical thinking skills, all of which contribute to a deeper and more meaningful understanding of the KPK and FPB. By improving students' understanding of mathematics learning on KPK and FPB materials, this research provides information to schools on how well their students understand the lesson. Future math teaching can be made better by educators and students. For students, this research can improve students' ability to understand the learning of mathematics on the material of KPK and FPB.

METHODS

Type and Design

The experimental technique is the kind of research methodology that was employed in the study. By applying one or more treatment conditions to one or more experimental groups and comparing the outcomes with one or more untreated control groups, experimental research seeks to investigate the potential of cause and effect (Setyanto 2013). The selection of this research model is based on the reason that this survey begins with practical problems in mathematics education with the object of research on understanding the Multiples of Small and Large Common Factors with the Project Based Learning learning model. With this method the researcher uses the students' learning space (classroom) for the learning activities offered. All experimental research focuses on the subject of forth grade students of State Elementary School 2 Selo Boyolali to improve understanding of the KPK and FPB concepts faced when learning Mathematics.

Data and Data Sources

Students in the fourth grade at State Elementary School 2 Selo Boyolali during the 2023–2024 academic year made up the study's population. This study's sampling strategy is the random sample approach, in which every member of the population has an equal chance of being chosen. This method was chosen because this method can ensure that the selected sample represents the entire population, the risk of selection bias is minimized, external factors that can affect the results can be controlled, and the nature of the method is relatively simple (Noor, Tajik, and Golzar 2022). The sample of this study was fourth grade students of State Elementary School 2 Selo Boyolali.

Data collection technique

The independent variable of this research is the application of Project Based Learning model in learning mathematics about KPK and FPB materials. While the dependent variable in this study is the ability to understand KPK and FPB of students. To obtain data, researchers collected data by using observation methods and pretest and posttest questions in the form of description questions to determine the development of student learning outcomes before and after learning with the Project Based Learning model.

Data analysis

The T test hypothesis test is a quantitative descriptive analysis method that was employed in the study's data analysis. The T test provides a statistical framework for drawing conclusions about population parameters from sample data by determining if the means of two groups vary statistically (Kim 2015). The T test performed is validated by conducting a data homogeneity test, and a data normality test as a prerequisite test. The data calculated is the student's posttest results by using the Independent T-test validity test formula with the level of error singification $\alpha = 0.05$ or 5%.

RESULTS AND DISCUSSION

The research data was obtained from the test process of experiment 1 (before), and experiment 2 (after) research conducted in accorppace with the steps of Project Based Learning.

The results of the research on fourth grade students of State Elementary School 2 Selo Boyolali located in the Boyolali Regency area have a sample of 29 students. The sample selection was done randomly in each experiment all students were involved in the research.

The research results were obtained from the posttest and pretest data of the ability to understand KPK and FPB with the PJBL model. Comparison of the improvement of the measurement results of students' understanding ability is presented in table 1.

Table 1. Measurement Results of Understanding Ability of KPK and FPB

Ability Measurement	**Experiment 1**	**Experiment 2**
Average Value	73,379	80,965
Maximum Score	90,0	95,0
Minimum Score	60,0	70,0
Standard deviation	8,1170	5,6091
Average Value	73,379	80,965

Data on the acquisition of KPK and FPB understanding ability through pretest and posttest with Project Based Learning learning model can be seen in Table 1. The results of the ability analysis of 29 students who have applied the Project Based Learning learning model obtained an average score of 80.965, a maximum score of 95.0 and a minimum score of 70.0. This result is an improvement when compared to the results of students' abilities before the use of the Project Based Learning method where the average score was 73.379, the maximum score was 90.0 and the minimum score was 60.0. The increase in the average score, minimum score and maximum score of students shows that relatively speaking, students understand the material better and are better able to apply the theory learned to the problems given after the application of the Project Based Learning model. The standard deviation of the data of experiment 2 with a value of 5.6091 is smaller than experiment 1 with a value of 8.1170. This shows that the student scores after the application of the Project Based Learning method are relatively more consistent with lower variation when compared to the student scores before the application of the Project Based Learning model. This is because the standard deviation measures how much individual data differs from the mean of the data set where a higher standard deviation value indicates greater variability, while a lower standard deviation value indicates that individual data values are closer to the mean value (El Omda dan Sergent 2023). This lower variation can be interpreted with a more even understanding of the material given where each student has an understanding that is not much different from one another. Thus from the following data it can be stated that students' understanding of the KPK and FPB material has increased and is distributed more consistently and evenly to each student as evidenced by the results of smaller standard deviations or homogeneity.

The data that has been obtained is then subjected to experimental prerequisite tests with data normality tests and data homogeneity tests. Researchers conducted a normality test to ensure that the dataset followed a normal distribution and a homogeneity test to ensure that the variation between datasets was consistent and did not have outliers (Rahmi, Rohmah, dan

Wulandari 2021). In addition, the normality test is important to do to ensure that the T test performed is accurate and statistically valid (Indra Cahya dan Amir Faisal 2023). The homogeneity test, which refers to a hypothesis testing procedure to determine the equality of the underlying distributions of two data samples, is important to ensure the validity of the data samples obtained (Sianturi 2022). For the sake of ease in analyzing homogeneity test data, researchers use IBM SPSS 25 for windows with the basic concept in testing if the Asymp.sing value. > 0.05 then the data is homogeneous, and if the Asymp.sing value <0.05 then the data is not homogeneous. From the basic concept statement, a hypothesis can be formulated H_0 is the variance of the two data is homogeneous and H_a is the variance of the data of the two groups is not homogeneous. The results of the calculation of the data homogeneity test of the two experiments using IBM SPSS 25 for windows are as follows.

Table 2. Homogeneity Test Results

Test of Homogeneity of Variances

		Levene Statistic	df1	df2	Sig.
Math Score	Based on Mean	5.607	1	56	.021
	Based on Median	4.561	1	56	.037
	Based on Median and with adjusted df	4.561	1	51.355	.037
	Based on trimmed mean	5.699	1	56	.020
	Based on Mean	5.607	1	56	.021

In the homogeneity test, the data sample can be declared homogeneous if the significance value is> 0.05. Based on the table of homogeneity test results, it can be seen that the significance value of the data samples based on the average and median> 0.05 so that from the data above the two data samples can be declared homogeneous and it can be decided that H_0 is accepted or the results of experimental value 1 and experimental result 2 are homogeneous.

The next prerequisite test is the normality test which aims to determine whether the data is normally or abnormally distributed. If the data is declared not normally distributed then the t-test cannot be continued. Formulated with the hypothesis H_0 is normally distributed data and H_a is abnormally distributed data. In this case the researchers tested the normality of the data using the Kolmogorov-smirnov test with the help of IBM SPSS 25 for windows with the basic concept of data normality test if the Asymp.sig value> 0.05 then the data is normally distributed and if the Asymp.sig value <0.05 then the data is not normally distributed.

Table 3. Normality Test Results

One-Sample Kolmogorov-Smirnov Test

	Unstandardized Residual

N		29
Skor Minimal Normal Parameters a,b	Mean	.0000000
	Std. Deviation	2.66816269
Most Extreme Differences	Absolute	.143
	Positive	.105
	Negative	-.143
Test Statistic		.143
Asymp. Sig. (2-tailed)		.137c

a Test distribution is Normal.
b Calculated from data.
c Lilliefors Significance Correction.

From the sample of student data above using Kolmogrov-smirnov with the help of IBM SPSS 25 for windows, it can be stated that the data is normally distributed as evidenced by the Asymp. Sig data is 0.137, in accordance with the basic concept of test calculation, it can thus be concluded that H_0 is normally distributed data is accepted with the results of the normality test, namely 0.137> 0.05.

Based on the results of the data described in the homogeneity test, it shows that the two data samples show homogeneous data variance, and the normality test shows that the two data samples have a normal distribution. Thus, the next hypothesis test carried out is the Independent Sample T Test. The Independent Sample T Test is a statistical method used to compare the mean values of two groups of data samples to determine whether there is a significant difference between the two groups. This test is a parametric test that assumes the data is normally distributed and the variances of the two groups are equal (Ross dan Willson 2018). Considering the samples for both sets of data are interval or ratio, this test is conducted. According to the decision-making framework, if the significance is more than 0.05, H_0 is accepted and H_a is rejected. This indicates that students using the Project Based Learning model will not be able to comprehend the KPK and FPB content much better. Additionally, if the significance value is less than 0.05, H_0 is accepted and H_a is denied, indicating that students using the Project Based Learning approach are becoming more adept at understanding the KPK and FPB content. The table below displays the findings of the hypothesis test:

Table 4. T-test Results

Independent Samples Test

	Levene's Test for Equality of Variances		t-test for Equality of Means					
	F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference

									Lower	Upper
Results Math Score	Equal variances assumed	5.607	.021	-4.141	56	.000	-7.586	1.832	-11.257	-3.916
	Equal variances not assumed			-4.141	49.776	.000	-7.586	1.832	-11.267	-3.906

Based on the table of hypothesis test results using the T test with the Independent Sample T Test technique carried out on the data sample, the results were obtained with a significant value of 0.000. Statistically, if the significant value is> 0.05, there is no significant difference between the two data groups, when the significant value <0.05 indicates there is sufficient evidence that there is a significant difference between the two data groups (Mishra et al. 2019). Due to the significant value <0.05, it can be stated that H_0 is rejected and H_a is accepted as the basis for decision making in the T test. This significant difference can be used as a parameter to assess the effectiveness of the PJBL model in learning KPK and FPB materials. The result of a small significant value (0.000) shows that there is a significant difference between the scores of students who learn KPK and FPB materials using the PJBL model and the scores of students who learn KPK and FPB materials conventionally. The results obtained are in accordance with the researcher's hypothesis and in line with the results of other PJBL model implementation assessment studies. The implementation of the PJBL model in social learning showed that students who learned using the PJBL model scored almost twice as high as students who learned with the conventional model (Febriana 2017). In addition, the implementation of the PJBL model in science subjects showed a 20% increase in student achievement (Afifah and Minsih 2021) The PBL model has learning steps that can actively involve students in solving learning problems both individually and in groups (Wahyuni et al. 2023). By using the PJBL model, student achievement and grades in mathematics can increase significantly.

This improvement in student achievement and grades can be explained by an increase in student understanding of the material provided. One of the main problems that hinder students in understanding the material provided by the learner in mathematics is the conventional learning process that is relatively static and focuses more on memorizing formulas (Minsih et al. 2020). Learning with the PJBL model can overcome this problem by presenting a more active learning model and involving students intensively. Other research shows that the implementation of PJBL in learning sessions facilitates discussion and information exchange between each other which leads to increased student engagement in learning sessions and student understanding of the material provided (Almulla 2020). This more active learning model can improve students' understanding more significantly when compared to conventional methods.

In addition, another factor that has the potential to contribute to improved student understanding is student independence in learning. Previous research shows that students who learn using conventional learning methods are more likely to be passive and dependent on others in the learning process (Sundari, Fuadi, and Hidayati 2022). Other research states

that independence in learning is an important factor in holistic student development and has the potential to improve student achievement (Minsih, Fuadi, and Rohmah 2023). The PJBL method can foster the nature of independence through the learning process carried out. Other research shows that the implementation of PJBL in mathematics learning can engage students in an inquisitive process that requires critical thinking, problem solving, collaboration, and creativity (Rézio, Andrade, dan Teodoro 2022). PJBL can also build important skills that generate reflective thinking in students, including observation, communication, teamwork, judgment, and decision-making (Hendriana et al. 2018). Therefore, the implementation of the PJBL model in learning sessions has proven to be effective and has clear advantages when compared to conventional learning methods. Problem-based learning emphasizes learning to solve problems by applying skills to identify, analyze, create, and present learning products (S. Mardhyyah 2023).

This makes the PJBL model very suitable in learning mathematics, a subject that requires students to think critically in problem solving. However, it cannot be denied that there are some hurdles that need to be faced in the implementation of this PJBL model. The PJBL model requires more energy and time in its implementation in learning sessions so that it requires more effort from students (Murniarti 2021). In addition, in the initial phase of implementing this PJBL model, students could potentially face difficulties in time and resource management so that this could potentially reduce the efficiency of this PJBL model (Aditama et al. 2022) (Aditama et al. 2022). However, this problem can be overcome by conducting a training process and conducting seminars for students in addition to providing adequate incentives and support from the school education board (Aditama et al. 2022).This study is also limited in terms of the number of samples available so further research into the efficacy and efficiency of the PJBL method in learning is welcome. Thus, it can be proven that the use of Project Based Learning model in learning mathematics with KPK and FPB material at State Elementary School 2 Selo Boyolali can improve students' understanding ability.

CONCLUSION

The learning process has to be changed methodically in an effort to raise student performance and quality. In addition to passively relying on traditional techniques, the learning process also makes use of active learning models that engage students and learners. One of the teaching strategies that students may use to increase their comprehension of the KPK and FPB content in mathematics is project-based learning. By putting this technique into practice, students not only get a deeper comprehension but also improve their critical thinking, creativity, and problem-solving flexibility.

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