Jurnal Ilmiah Wahana Pendidikan, June 2025, 11 (6.B), 217-224
DOI: https://jurnal.peneliti.net/index.php/JIWP/article/view/12061
p-ISSN: 2622-8327 e-ISSN: 2089-5364
Accredited by Directorate General of Strengthening for Research and Development
Available online at https://jurnal.peneliti.net/index.php/JIWP

Improving Understanding of KPK and FPB Concepts through the Use of PAKABE Teaching Aids in Mathematics Learning

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Received: *3 Mei 2025*
Revised: *15 Mei 2025*
Accepted: *30 Mei 2025*

Abstrack

This study investigates the effectiveness of PAKABE (KPK and FPB Boards) as a teaching aid in enhancing elementary students' understanding of mathematical concepts, particularly the Least Common Multiple (LCM) and Greatest Common Factor (GCF). Employing a quasi-experimental design with a pretest-posttest control group, the research involved Grade V students from SD Negeri Gunungtajem. The experimental group received instruction using PAKABE integrated with a Project-Based Learning (PJBL) approach, while the control group was taught using conventional methods. Data were collected through written tests, observation sheets, student response questionnaires, and documentation. Results indicated a significant improvement in the experimental group's learning outcomes, with the number of students meeting the Achievement Level Completeness Criteria (KKTP) increasing from 6 to 14. Students also responded positively to the use of PAKABE, demonstrating increased motivation and engagement. These findings highlight the potential of contextual and interactive teaching aids to improve conceptual understanding and student participation in mathematics learning.

Keywords: *PAKABE, Least Common Multiple (LCM), Greatest Common Factor (GCF), Project-Based Learning, Teaching Aids, Mathematics Learning, Elementary School*

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How to Cite: Nurohman, N., Wasino, W., & Handoyo, E. (2025). Improving Understanding of KPK and FPB Concepts through the Use of PAKABE Teaching Aids in Mathematics Learning. Jurnal Ilmiah Wahana Pendidikan, 11(6.B), 217-224. Retrieved from https://jurnal.peneliti.net/index.php/JIWP/article/view/12061

INTRODUCTION

Mathematics learning has an important role in developing students' logical, critical, and analytical thinking skills from an early age. Mathematics is not only the basis for other subjects, but also the foundation in everyday life to solve various problems systematically (Purwanto, 2017). However, in practice, many elementary school students have difficulty in understanding abstract concepts in mathematics, one of which is the concept of Least Common Multiple (LCM) and Greatest Common Factor (GFP). These concepts require high-level thinking skills, such as an understanding of numbers, relationships between numbers, and the ability to identify patterns (Sudjana, 2016).

This difficulty is generally caused by the use of conventional learning methods. Students tend to be directed to memorize formulas without understanding the meaning or concept behind them (Alfina & Kusuma, 2020). As a result, students' understanding of the KPK and FPB concepts becomes shallow, and they have difficulty when they have to apply these concepts in solving contextual problems (Nugroho & Fitriani, 2020). Meaningless learning and minimal interaction can also reduce students' learning motivation and cause them to easily feel bored and depressed in learning mathematics (Suryani, 2018).

One approach that can be applied to improve students' understanding of mathematical concepts is the use of media or learning aids. Teaching aids allow students to directly experience the learning process through visual, concrete, and manipulative approaches, so that abstract concepts can be more easily understood (Susanto & Wahyuni, 2021; Piaget in Suparno, 2015). In the context of learning KPK and FPB, teaching aids play an important role in helping students identify multiples and common factors concretely through structured steps. In addition, learning based on teaching aids has also been proven to increase students' interest and motivation to learn because it involves interactive and fun elements (Rahmawati & Setiawan, 2021).

One form of learning media innovation that can be used is PAKABE (KPK and FPB Board). PAKABE is a visual board-shaped tool specifically designed to make it easier for students to understand the concepts of KPK and FPB more systematically and interactively. Through PAKABE, students can explore and practice directly in determining multiples and common factors of two or more numbers. This media is designed not only as a visual aid, but also to actively involve students in the learning process (Hakim, 2019). Thus, students are expected not only to memorize formulas, but also to be able to understand concepts through meaningful learning experiences.

Previous research has shown that the use of teaching aids in mathematics learning can increase student engagement and concept understanding. Nugroho & Fitriani (2020) showed that contextual media helped students be more active in learning KPK and FPB. Susanto & Wahyuni (2021) also emphasized that visual media can reduce concept errors that often arise when students learn only through the lecture method. Fathurrahman & Sari (2018) found that the use of concrete media improved students' ability to link the concepts of KPK and FPB with the relationship between numbers more comprehensively. In addition to the impact on understanding, the use of teaching aids such as PAKABE also contributes to increasing students' learning motivation. When students are involved in fun learning activities, their curiosity and desire to understand the material will increase (Supriyadi & Lestari, 2019). This is reinforced by Yuliana & Ramadhani (2022) who stated that interactive media can create a positive learning atmosphere and contribute to improving student learning outcomes in KPK and FPB materials.

Based on this description, this study aims to examine the effectiveness of using PAKABE props in improving understanding of the concepts of KPK and FPB in elementary school students. In addition, this study also explores how students respond to the use of this tool in the mathematics learning process. It is hoped that the results of this study can make a positive contribution to the development of learning media that is innovative, applicable, and can be widely applied at the basic education level (Kurniawan, 2020; Putri & Hidayat, 2019).

RESEARCH METHOD

Types and Approaches to Research

This research is a quantitative research with a quasi-experimental design approach. This approach is used because the research conditions do not allow for full randomization of the research subjects (Sugiyono, 2018). This study aims to determine the effectiveness of the use of PAKABE props (KPK and FPB Boards) in improving students' understanding of mathematical concepts, especially in the materials of the Smallest Common Multiples (KPK) and the Largest Common Factors (FPB).

Research Design

The design used in this study is Pretest-Posttest Control Group Design. This design involves two groups, namely: The experimental group, who received learning with the Project-Based Learning (PJBL) model assisted by PAKABE props. The control group, which followed mathematics learning with a conventional approach (lectures and practice questions) without props. Both groups were given a pretest to determine the initial level of understanding of the KPK and FPB materials. After learning, the two groups were again given a final test (posttest) to see the improvement in learning outcomes and compare the effectiveness of the learning approach used (Creswell, 2015; Sudjana & Rivai, 2020).

Research Subject

The subjects in this study are grade V students at one of the State Elementary Schools in Brebes Regency. The selection of subjects was carried out by purposive sampling technique, which is based on the consideration that the class has characteristics and conditions that are relevant to the research purpose, as well as the availability of partner teachers and supporting facilities (Arikunto, 2016).

Learning Approach: Project-Based Learning (PJBL)

The Project-Based Learning (PJBL) approach was chosen because it has characteristics that are in accordance with the research objectives, which are to encourage students to understand concepts through active involvement in real projects. In the context of mathematics learning, especially KPK and FPB materials, PJBL can help students understand concepts through exploration, discussion, and problem-solving activities based on teaching aids such as PAKABE (Mergendoller et al., 2006; Arsyad, 2019). PJBL has also been proven to increase motivation, creativity, and cooperation between students (Wena, 2011).

Research Instruments

The instruments used in this study include:

Written Test

Multiple-choice tests and descriptions were used to measure students' understanding of the concepts of KPK and FPB before and after treatment. The questions were compiled based on learning indicators and have been validated by experts (Putri & Hidayat, 2019).

Observation Sheet

It is used to observe student activities during the learning process, especially involvement in projects, the use of PAKABE teaching aids, and interactions between students (Yuliana & Ramadhani, 2022).

Student Response

It was used to measure students' responses and motivation to the use of PAKABE media. The questionnaire uses a Likert scale with four selected categories (Suryani, 2021).

Documentasion

Documentation in the form of photos, videos, and field notes is used to support observational findings and provide a concrete picture of the implementation of learning.

Data Analysis Techniques

Data analysis is carried out through several stages:

Quantitative Analysis

The pretest and posttest results of both groups were analyzed using the Paired Sample t-Test and Independent Sample t-Test statistical tests. The goal is to find out:

Was there a significant improvement in conceptual understanding after treatment in each group?

Is there a significant difference between the experimental group and the control group after learning (Sugiyono, 2018).

Descriptive Analysis

Data from observations and questionnaires were analyzed in a quantitative descriptive manner to see the level of student involvement in the learning process and how they responded to the use of PAKABE media (Hakim, 2019; Supriyadi & Lestari, 2019).

Instrument Validity and Reliability

To guarantee the validity of the instrument:

The validity of the content is carried out through expert judgment from lecturers and mathematics teachers.

The reliability of the instrument was tested using the Alpha Cronbach test on questionnaires and test questions through a preliminary test.

RESULTS AND DISCUSSION

Research Results

The implementation of mathematics learning using PAKABE teaching aids (KPK and FPB Boards) showed a significant increase in students' understanding of KPK and FPB materials. This is evidenced by the learning outcomes of grade V students of SD Negeri Gunungtajem in semester 1 of the 2024/2025 school year.

Based on the data collected, only 6 out of 15 students achieved a score above the KKTP (Achievement Level Completeness Criteria) of 70 before the implementation of PAKABE media. However, after the implementation of the media, the number of students who met the KKTP increased to 14 students. There was an increase in scores in almost all students, with some students experiencing a jump in scores of 15–25 points from their initial score.

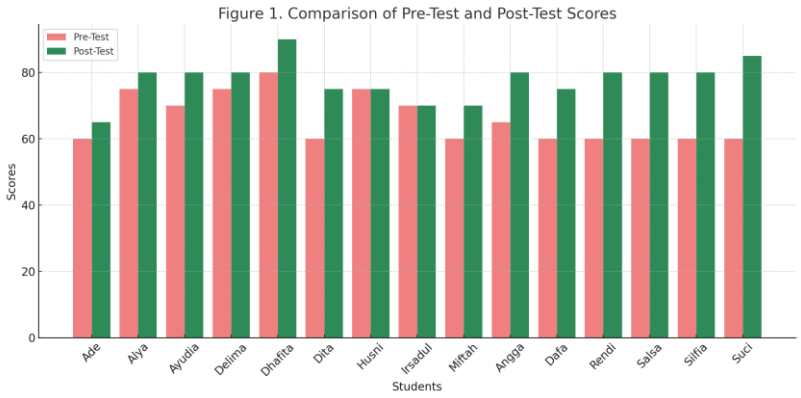
For example, students on behalf of Suci Rahmadani received an increase from 60 to 85, and Rendi Saputra from 60 to 80, showing that PAKABE media contributes to clarifying abstract concepts that were previously difficult for students to understand.

This result is in line with the findings of Nugroho and Fitriani (2020) who stated that contextual-based teaching aids can increase students' activities and understanding of KPK and FPB materials. PAKABE as a visual and interactive tool is able to facilitate students in identifying multiples and factors of two or more numbers in an easy and fun way (Alfina & Kusuma, 2020; Susanto & Wahyuni, 2021).

Table 1. List of values before and after using PAKABE media

No	Student's name	Value	
		Before	**After**
1	Ade Erpan Sunendar	60	65
2	Alya Nurjanah	75	80
3	Ayudia Sevira	70	80
4	Delima Puspita Sari	75	80
5	Dhafita Niza Nur Azizah	80	90
6	Dita Amanah	60	75
7	Husni Mubarok	75	75
8	Irsadul Ibad	70	70
9	Miftah Varid Arroihan	60	70
10	Muhamad Angga Pratama	65	80
11	Muhammad Dafa Akmalatif	60	75
12	Rendi Saputra	60	80
13	Salsa Ayuna Putri	60	80
14	Silfia Anggita Rahayu	60	80
15	Suci Rahmadani	60	85

Figure 1. Comparison of Pre-Test and Post-Test Scores of Students using PAKABE Media.



DISCUSSION

The improvement in student learning outcomes indicates that the use of PAKABE teaching aids is more effective than conventional learning methods in delivering mathematical concepts, particularly the Least Common Multiple (LCM) and Greatest Common Factor (GCF). Conventional approaches often rely heavily on rote memorization of formulas without providing meaningful or contextualized learning experiences, which limits students' conceptual understanding (Alfina & Kusuma, 2020).

In contrast, the PAKABE media integrates visual and manipulative learning that supports the constructivist learning theory, where knowledge is actively constructed by the learner rather than passively received. According to Piaget and later elaborated by Bruner, students progress through three stages of cognitive representation: enactive (learning by doing), iconic (learning through images), and symbolic (learning through abstract symbols). PAKABE enables students to move from the enactive stage—physically manipulating representations of multiples and factors—to the iconic stage—visualizing number relationships on the board—before finally applying symbolic understanding to solve abstract problems.

This layered process may explain why students in the experimental group showed a significant improvement in test scores and exhibited greater motivation. Students were not only learning the "what" of KPK and FPB, but also the "how" and "why," fostering deeper cognitive processing and retention.

Moreover, the Project-Based Learning (PJBL) model used alongside PAKABE enhances student collaboration and real-world problem-solving. Working in groups encourages students to articulate their reasoning, negotiate meaning with peers, and reflect on their own understanding—activities that are central to social constructivism (Arsyad, 2019). Such collaborative engagement is often lacking in conventional instruction, where teacher-centered lectures dominate the learning environment.

However, this study also has certain limitations that should be acknowledged. First, the sample size was relatively small (15 students), which limits the generalizability of the findings. The intervention was conducted in only one class at a single school, which means the outcomes may be influenced by specific contextual factors such as teacher expertise, classroom dynamics, or school support. Additionally, the study only measured short-term learning gains; further research could investigate whether the conceptual understanding fostered by PAKABE is retained over time.

Despite these limitations, the results offer valuable insights into the role of interactive and contextual media in supporting mathematics education. PAKABE not only helped make abstract mathematical concepts more accessible but also promoted student engagement and collaboration—two key factors in successful learning. Future studies could expand on this work by involving more diverse populations, integrating digital versions of PAKABE, or comparing its impact across different mathematical topics.

Obstacles and Advantages

Constraints

1. In the implementation of media-based learning such as PAKABE, some of the obstacles faced include:
2. Limited facilities and infrastructure in schools that support innovative learning.
3. Economic limitations for some parents make it difficult to procure tools and materials.
4. The lack of a student reading culture, which has an impact on understanding instructions or steps of activities independently.

On the other hand, the implementation of PAKABE media provides a number of advantages:

1. The emergence of new innovations in mathematics learning strategies in the classroom.
2. Increase teacher innovation in delivering abstract material. Foster interest in learning and strengthen student cooperation in groups.
3. Become an alternative learning reference that is applicable to other teachers. Encourage students to be more independent and active in understanding mathematical concepts.
4. The establishment of cooperation and good relations between students through group work.

Providing alternative references for teachers in delivering abstract material with a more contextual and fun approach (Yuliana & Ramadhani, 2022).

CONCLUSION

Based on the findings of this study, it can be concluded that the use of PAKABE (KPK and FPB Boards) is effective in enhancing elementary students' conceptual understanding of mathematical topics, particularly the Least Common Multiple (LCM) and Greatest Common Factor (GCF). When integrated with the Project-Based Learning (PJBL) approach, PAKABE promotes active student engagement, provides meaningful and concrete learning experiences, and increases students' motivation and interest in mathematics.

The results demonstrated a significant improvement in learning outcomes, with the number of students meeting the Achievement Level Completeness Criteria (KKTP) rising from 6 to 14 after the implementation of PAKABE. This suggests that visual and interactive teaching aids can play a critical role in bridging the gap between abstract concepts and student comprehension.

Furthermore, the use of PAKABE fosters collaboration and encourages a more interactive classroom environment. Although some challenges were encountered—such as limited school infrastructure and a low reading culture among students—the educational benefits outweighed these constraints. Therefore, PAKABE is recommended as an innovative and practical alternative for improving mathematics instruction at the elementary level and can serve as a model for similar interventions in other schools and subject areas.

BIBLIOGRAPHY

Alfina, D., & Kusuma, D. (2020). Pengembangan alat peraga matematika untuk materi KPK dan FPB di sekolah dasar. Jurnal Pendidikan Matematika, 12(3), 157–167.

Arikunto, S. (2016). Prosedur penelitian: Suatu pendekatan praktik. Jakarta: Rineka Cipta.

Arsyad, A. (2019). Media pembelajaran. Jakarta: RajaGrafindo Persada.

Creswell, J. W. (2015). Educational research: Planning, conducting, and evaluating quantitative and qualitative research (5th ed.). Boston: Pearson Education.

Fathurrahman, M., & Sari, D. (2018). Penggunaan media konkret untuk meningkatkan pemahaman konsep matematika siswa SD. Jurnal Edukasi Matematika, 6(2), 134–142.

Hakim, L. (2019). Desain alat peraga visual dalam pembelajaran matematika sekolah dasar. Jurnal Inovasi Pendidikan, 10(1), 55–62.

Kurniawan, D. (2020). Pengembangan media pembelajaran berbasis alat peraga untuk meningkatkan hasil belajar siswa. Jurnal Teknologi Pendidikan, 22(1), 73–81.

Mergendoller, J. R., Maxwell, N. L., & Bellisimo, Y. (2006). The effectiveness of problem-based instruction: A comparative study of instructional methods and student characteristics. Interdisciplinary Journal of Problem-Based Learning, 1(2), 49–69.

Nugroho, A., & Fitriani, S. (2020). Pengembangan alat peraga KPK dan FPB dengan pendekatan kontekstual untuk meningkatkan aktivitas siswa. Jurnal Pendidikan Matematika dan Sains, 14(3), 112–120.

Putri, L., & Hidayat, T. (2019). Pengembangan instrumen penilaian kognitif matematika. Jurnal Evaluasi Pendidikan, 10(2), 88–95.

Rahmawati, A., & Setiawan, H. (2021). Meningkatkan motivasi belajar matematika melalui media pembelajaran interaktif. Jurnal Pendidikan dan Teknologi, 5(1), 22–29.

Sudjana, N. (2016). Metode statistika. Bandung: Tarsito.

Sudjana, N., & Rivai, A. (2020). Media pengajaran. Bandung: Sinar Baru Algensindo.

Suparno, P. (2015). Teori konstruktivistik Piaget dan implikasinya dalam pembelajaran. Yogyakarta: Kanisius.

Supriyadi, E., & Lestari, M. (2019). Pengaruh media konkret terhadap hasil belajar matematika siswa sekolah dasar. Jurnal Pendidikan Dasar, 10(2), 145–152.

Susanto, A., & Wahyuni, R. (2021). Inovasi media pembelajaran matematika dengan alat peraga interaktif pada materi KPK dan FPB. Jurnal Media Pembelajaran Matematika, 15(1), 45–53.

Suryani, T. (2018). Analisis kesulitan belajar matematika siswa sekolah dasar. Jurnal Pendidikan Dasar, 9(1), 12–21.

Suryani, T. (2021). Analisis respon siswa terhadap media pembelajaran interaktif di sekolah dasar. EduBasic Journal, 3(2), 33–41.

Wena, M. (2011). Strategi pembelajaran inovatif kontemporer. Jakarta: Bumi Aksara.

Yuliana, S., & Ramadhani, R. (2022). Penerapan media interaktif dalam pembelajaran KPK dan FPB. EduSains, 14(1), 66–73..