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Article

The Concrete-Pictorial-Abstract Approach to the Achievement of Mathematics Learning Outcomes of Elementary School Students in terms of Early Mathematical Abilities

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ABSTRACT

Low student mathematics learning outcomes should be a concern at this time, because low learning outcomes indicate that learning objectives have not been achieved. This study aimed to see how far the achievement of students' mathematics learning outcomes (MLO) is through the concrete-pictorial-abstract (CPA) approach based on students' early mathematical abilities (EMA). The study used a quasi-experimental through a nonequivalent pretest-posttest control group design. One hundred nineteen 5th-grade elementary school students in Purwakarta, Subang, Karawang, and Bekasi districts participated in this study on the volume of cubes and rectangular prisms. The research instrument used tests and non-tests, which were analyzed with descriptive and inferential statistics. The findings show that the achievement of MLO of students who receive learning with the CPA approach is better than conventional learning (CPA: 64,32 and Conventional: 56,32) p-value 0,001<0,05. Achievement of students' MLO in learning CPA and conventional in the high EMA group is in the high category (CPA: 75,31 and Conventional: 78,00) p-value 0,343>0,05. Achievement of students' MLO in learning CPA and conventional in the Moderate EMA group is in the medium category (CPA: 61,62 and

Conventional: 51,54) p-value 0,003<0,05. Achievement of students' MLO in learning CPA and conventional in the Low EMA group is in the medium category (CPA: 55,00 and Conventional: 36,36) p-value 0,012<0,05. Thus, the concrete-pictorial-abstract approach can be an alternative to developing MLO for students with high, medium, or low mathematical abilities.

1. Introduction

Mathematics is part of the subjects that students from Early Childhood Education must master in High School. Particularly in elementary school, Mathematics is the main subject at every grade level. The goals of learning mathematics in primary schools are to prepare students to deal with various changing circumstances in life, develop numeracy skills, and use a mathematical mindset in everyday life. The function of learning mathematics in primary schools is as a tool, mindset, and understanding to solve problems encountered in everyday life (Lesthary, Tampubolon, & Salimi, 2014). Thus, understanding mathematical concepts will help students solve everyday problems, especially those requiring mathematical skills.

Understanding the basic concepts of mathematics is very necessary for students. Studies find that learning math can make students able to deal with their real-life problems (Fajri, 2018) as explained clearly as follows, the relationship between the benefits of mathematics for everyday life has a practical value in supporting human life; first, studying mathematics can solve problems such as measuring distances and others; second, helping to calculate trade when receiving and paying back the buyer's money so as not to lose; third, can train accurate thinking and intelligent thinking; fourth, make people think systematically and careful; fifth, making a person think broadly, logically and not assumptions, presumptions, or guesswork; sixth, making people trained to calculate accurately and quickly, especially for those who like people in business, seventh, able to concludes deductively and eighth, make someone thorough, thorough, and patient in analyzing data (Marliani, 2021). At all educational levels, even understanding math will aid pupils in effectively and speedily achieving their educational goals (Maloku, Ebner, & Ebner, 2018) because learning mathematics can help children develop critical, creative, and logical thinking skills as well as their accuracy and patience. Mathematics greatly supports other fields (Oktafianti, Purwoko, & Astuti, 2019). Besides that, when students feel the ease of learning mathematics can make students appreciate and love mathematics (Hendriana, 2014).

Based on this description, students with exemplary achievements or learning outcomes in mathematics will be able to solve everyday problems creatively, thoroughly, logically, and accurately, making it easier to learn other sciences.

Learning results in mathematics are still comparatively low because there are still issues with mathematics education. Because they just memorize mathematical formulas without understanding the concept of the problem, students often have difficulty solving problems. They cannot solve difficulties when they forget mathematical formulas, and they believe that learning mathematics is complicated, confusing, and tiresome (Nurhayani & Hapsan, 2019). Even though individual learning achievements can reach optimal levels, student mathematics learning outcomes still fall short of expectations. However, it needs to be improved so that each student can improve their learning achievement. External variables like poor physical facilities, expensive educational costs, and inconsistent quality of competent teachers all impact student learning results (China, Syahrial, Ibrahim, & Albaar, 2020). Another reason is that mathematics is still often considered by students as a complex subject, and it is not uncommon for students not to be interested in studying mathematics in class and even avoid it. When given homework, sometimes students choose not to do it. This is why primary school children's mathematics learning results remain relatively weak. (Rhosyida, Trisniawati, & Muanifah, 2020).

Statistical analysis revealed that 143 learners, or approximately 98.62% of those with inferior mathematics learning outcomes, scored below the minimum completeness criteria, or 68 (Lutfi, Faelasofi, & Nihayati, 2022). Learning outcomes by the Minimum Completeness Criteria are the hopes of all teachers. However, the fact is that mathematics learning outcomes are still not as expected because they are still in the low category (Miftachurohmah et al., 2022; Murtiyasa & Al Karomah, 2020; Nuansa & Khasanah, 2017; Ratnasari, Agung, & Sudatha, 2021; Sarjono, 2021; Yanse, 2020). Similar results reveal that all students' mathematical learning outcomes are above the minimal completeness threshold. However, 43% of students fall into the group of low student learning outcomes. (Suherlan, Khuzaini, & Marhaeni, 2022). This problem is also found at SDN Gugus Tamansari Kebumen, where the mathematics learning outcomes of sixth-grade students are still low. The fourth-grade teacher's observations at SDN Gugus Tamansari Kebumen reveal that mastering mathematics still gives unsatisfactory outcomes (Safitri & Trimurtini, 2020). According to actual data, fourth-grade learners at SD Negeri 16 Bengkulu City still had poor learning outcomes in mathematics (Purdiyanto et al., 2021). Explicitly, student performance in mathematics learning and mathematical communication is still low. (Darto, 2021).

To achieve optimal mathematics learning outcomes, a strategy is needed to overcome this problem. Previous researchers have made several attempts. The outcomes of teaching fifth-grade primary school learners mathematics utilizing classroom action research techniques through snakes and ladders revealed that in cycle I, 47% of students finished and 53% did not, with an average of 63.10 points. Cycle II students had an average grade of 70.71, with a completion rate of 67% and a failure rate of 33%. At the same time, the third cycle of pupils has an average value of 73.33 for those who finish 80% and those who have not completed 20%. (Saputra, Yuliati, & Rachmadtullah, 2019). Studies on Classroom Action Research using the

Kahoot learning game application for fourth graders at the Tomohon primary school have shown that students' learning outcomes in mathematics increased from cycle one to cycle three, reaching 64, 72, and 81. From cycle one to cycle three, the instructor and student activity percentages climbed, reaching 77, 80, and 86%, respectively (Umboh, Tarusu, Marini, & Sumantri, 2021). Another study showed that the results of the N-Gain Test for the experimental class using the TGT learning model assisted by the Quizizz application were 63% categorized as "Effective," while the control class was 30% categorized as "Less Effective" for fifth graders of elementary schools in Demak City (Munir, Misbahul, Murtono, & Darmanto, 2022). It can be concluded that the problem-based learning model has a positive impact on the mathematics learning outcomes of sixth-grade students at an elementary school in Kendari City that is accredited B based on the results of descriptive and inferential analysis, which show that the problem-based learning model is better than direct learning (Kaharuddin, 2019). Discovery Learning has a favorable impact on student mathematics learning outcomes in the areas of cognition, affect, and motor function, according to a study of 20 articles using the systematic literature review method for students in elementary school through high school between the years of 2008 and 2018. (Kamaluddin & Widjajanti, 2019).

Previous research shows that various efforts have been made to improve student mathematics learning outcomes, but even though action research still does not show maximum results, the learning model with games in mathematics with the help of devices also shows that the increase is not high. The use of problem-based learning in institutions with specific accreditations is still seen as inadequate to represent the public, and this holds for learning by discovery, which is examined using the literature technique but is still insufficient to serve as a benchmark for the sample. Thus, there is a need for research that can identify disparities in the learning outcomes for mathematics across a range of skills and, of course, by the stages of primary school pupils' mathematical thinking and meaning.

Research through quasi-experimental methods with the Application of the Concrete-Pictorial-Abstract (CPA) and conventional learning can be a solution to see the significant achievement of mathematics learning outcomes based on diverse student abilities or basic knowledge with learning appropriate to the thinking stage of elementary school children. The tangible and graphical stages of the CPA method give learning significance. The CPA approach's main component is learning guidance, composed of distinct steps that allow students to control learning materials. Using illustrated phases, students can connect themes and conceptual stages—the foundation of learning mathematics that uses symbols. According to Piaget's theory, the concrete operational level is where the CPA learning method seeks to produce learning experiences that are as similar to the real lives of students or children as possible (Yuliyanto & Turmudi, 2020). The CPA approach to learning may be used to build and enhance primary school students' mathematical reasoning skills for each group of early mathematical abilities (high, medium, and poor) (Putri et al., 2020). Learning stages with the CPA approach always create mathematics learning that is as close to students' daily lives (Putri, Yuliyanto, Nikawanti, Rahayu,

& Majid, 2020). The CPA approach is learning with three stages, namely concrete, pictorial, and abstract, allowing students to learn mathematics in real terms by utilizing concrete objects around them and then visualizing them and turning them into mathematical symbols. Because CPA may make learning meaningful for children via tangible and graphical procedures, it is thought to boost students' self-efficacy and mathematics success (Yuliyanto, Turmudi, Agustin, Muqodas, & Putri, 2020). However, implementing the CPA approach in learning presents potential pitfalls for students in developing their mathematical abilities when they view the use of manipulative objects as an activity that is just playing to fill time rather than providing an opportunity to improve students' mathematical understanding.

Along with the CPA strategy used in this study, conventional teaching approaches such as lectures, direct discussions, question-and-answer sessions, and demonstrations are also used to impart knowledge. This is in line with studies that say the conventional learning approach is teacher-centered and generally uses the lecture method (Yuliyanto, Fadriyah, Yeli, & Wulandari, 2018). While the early mathematical abilities studied were students' basic knowledge of mathematical concepts, which functioned to study other materials. Early mathematical competence refers to learners' capacity to comprehend the foundational concepts in the later-taught content. (Yuliyanto & Turmudi, 2020).

According to the above explanation, the purpose of this study is to comprehend how well students who study mathematics using CPA learning and traditional learning—both generally and for those with high, medium, and poor baseline mathematical abilities—perform in terms of learning outcomes. Therefore, the issue under discussion is if there is a difference between the average mathematics learning results of students who study using CPA learning and conventional learning, both overall and for medium and low baseline mathematical ability.

2. Methods

This study used a non-equivalent control group design to examine how fifth-grade primary school pupils performed on their mathematics learning objectives. All public elementary school children in Purwakarta, Subang, Karawang, and Bekasi made up the study's population. Participants involved as a sample were 119 fifth-grade elementary school students in two public elementary schools in Cikampek District, Karawang Regency. Using a purposive sampling strategy, there were 59 students in the experimental group and 60 in the control group. The research instrument used to measure learning outcomes and students' initial mathematical abilities is a test instrument in the form of five essay questions that have been validated by experts and tested for validity and reliability. To test the validity of instruments that are classified as quantitative, the following validity and reliability formulas can be used (Widoyoko, 2017):

$$r_{xy} = \frac{N\sum xy - (\sum x)(\sum y)}{\sqrt{[N\sum x2 - (\sum x)2][N\sum y2 - (y)2]}}$$

Five valid questions were acquired with extremely high criteria (r_{xy} = 0,80), and reliability is high (r_{11} = 0,89) based on the test findings of the learning outcomes test instrument. The topic tested in this study is the volume of cubes and rectangular prisms. Utilizing descriptive and inferential statistics, data analysis was carried out. Descriptive statistics by analyzing the posttest mean and standard deviation with the help of Microsoft Office Excel. To determine the average value ($\bar{x}$) and standard deviation (sd) on the achievement criteria of MLO students, the combined rules of Normative Reference Assessment (NRA) and Benchmark Reference Assessment (BRA) are used. The formula used to determine the average value ($\bar{x}$) and standard deviation (sd) the rules for the combined assessment of NRA and BRA are as follows (Suherman & Kusumah, 1990):

$$\bar{x} = 1/2\ (\bar{x}NRA + \bar{x}BRA) \text{ and sd} = 1/2\ (sdNRA + sdBRA)$$

To determine the average value ($\bar{x}$) and standard deviation (sd) NRA the following formula is used (Suherman & Kusumah, 1990):

$$\bar{x} = 1/2 \text{ Ideal Maximum Score and sd} = 1/3\ \bar{x}$$

To determine the average value ($\bar{x}$) and standard deviation (sd) BRA the following formula is used (Sugiyono, 2017):

$$\bar{x} = \Sigma xin \text{ and sd} = \sqrt{}\Sigma(xi - \bar{x})2(n-1)$$

Notes: n = Number of samples; Σ = Amount; xi = i-th value

While inferential statistics by using the t-test or Mann Whitney U or Wilcoxon depending on the results of the prerequisite Test to obtain data on differences in average achievement in learning mathematics. Inferential statistics is done with the help of SPSS 25 for Mac. The procedure of this research is described in the following chart:

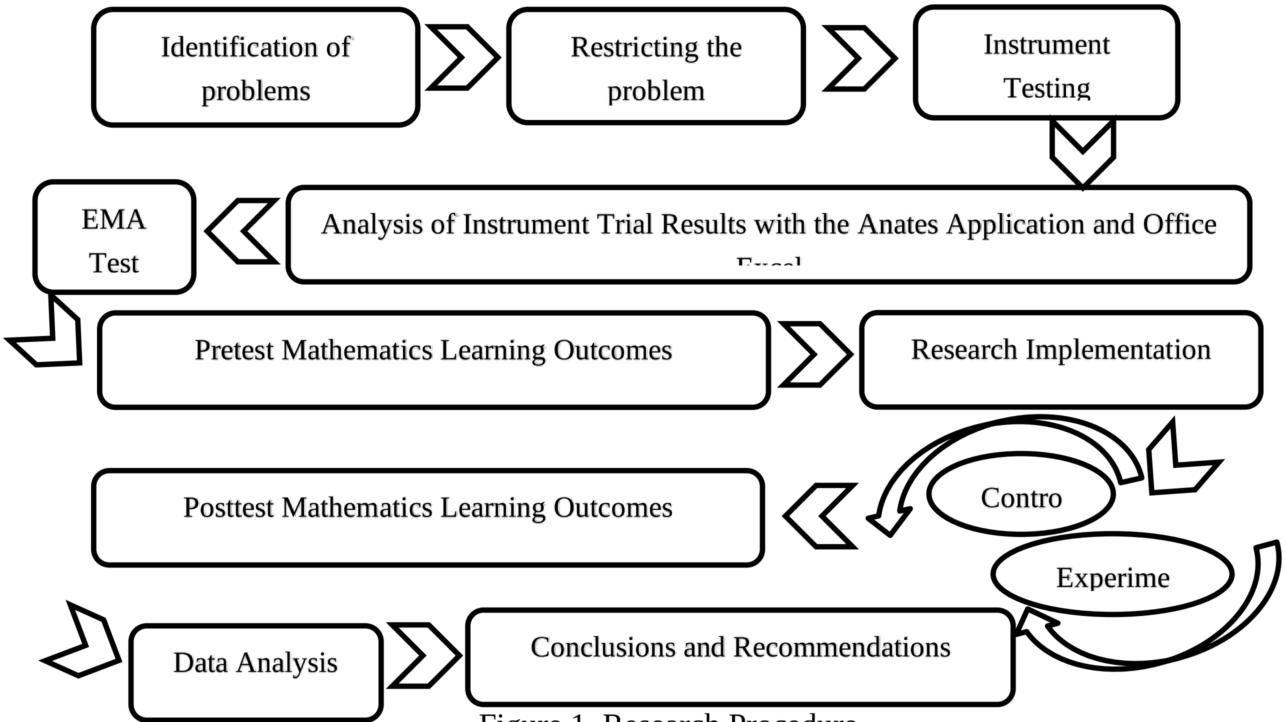


Figure 1. Research Procedure

3. Result and Discussion

The achievement of student learning outcomes is obtained from the final test results after giving treatment or learning, namely the posttest. Criteria for achieving student mathematics learning outcomes are grouped using the combined criteria of Benchmark Reference Assessment and Normative Reference Assessment (Suherman & Kusumah, 1990). The score that has been obtained is converted first in the form of a scale of 10-100. The recapitulation of the results of the analysis to determine the criteria for achieving mathematics learning outcomes can be seen in Table 1 below:

Table 1. Category for Achievement Student Mathematics Learning Outcomes

Achievement Score Interval	**Achievement Criteria**
$\bar{x} \geq 71$	High
$36 < \bar{x} < 71$	Medium
$\bar{x} \leq 36$	Low

Descriptive Analysis of Achievement of Mathematics Learning Outcomes based on Overall Learning and Early Mathematical Ability Groups

Table 2 below summarizes the posttest score findings for students' mathematics learning outcomes based on overall learning:

Table 2. Recapitulation of Achievement of Student Mathematics Learning Outcomes based on Overall study

Posttest	**Learning**	**Score**		$\bar{x}$	***sd***
		Smallest	**Biggest**		
Mathematics Learning Outcomes (IMS= 95)	CPA	15	95	64,32	19,84
	Conventional	20	90	52,63	18,72

(Note: IMS = Ideal Maximum Score

Even though the accomplishment requirements in the two learning groups were moderate, Table 2 demonstrates that students who study using the CPA technique achieve mathematical learning outcomes at a greater rate than students who receive conventional instruction. In addition, Table 3 provides a summary of the outcomes of the posttest study of mathematical learning outcomes based on learning for the EMA group:

Table 3. Recapitulation of Achievement of Student Mathematics Learning Outcomes reviewed by EMA

Posttest	EMA Group	Learning	Score		$\bar{x}$	*Sd*
			Smallest	Biggest		
Mathematics Learning Outcomes (IMS= 95)	High	CPA	30	95	75,31	22,91
		Conventional	55	90	78,00	10,06
	Medium	CPA	15	85	61,62	17,53
		Conventional	25	85	51,54	14,92
	Low	CPA	30	70	55,00	15,21
		Conventional	20	70	36,36	16,14

Table 3 demonstrates that, except for the high EMA group, students in each EMA group who received CPA learning outperformed those who studied with conventional learning in terms of their mathematics learning outcomes. The success of student learning outcomes for each EMA group in both learning groups is in the high category for the high EMA group, while the medium and low EMA groups in CPA and conventional learning are categorized as moderate. In the class that investigated CPA learning, Table 3 also demonstrates the accomplishment of students' mathematics learning outcomes in the high EMA group, which was higher than the medium and low EMA groups. In a similar vein, children in the high EMA group appear to acquire higher levels of mathematical learning outcomes than their counterparts in the medium and low EMA groups.

Thus, compared to traditional learning, the CPA technique can improve students' mathematics learning outcomes in each EMA group. Students in the high EMA group who received CPA learning had more advanced mathematics learning results than students in the medium and low EMA groups. The following section includes a graphic that illustrates the differences between the EMA group and other learning groups regarding how well students achieved their learning objectives.

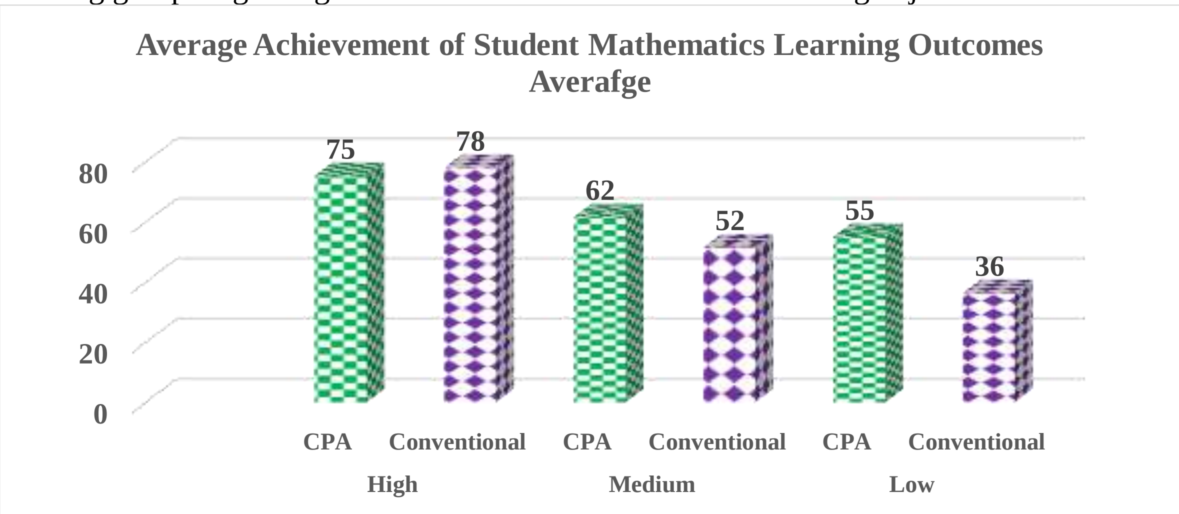


Figure 2. Average Achievement of Mathematics Learning Outcomes in terms of EMA

Inferential Analysis of Achievement of Mathematics Learning Outcomes based on Overall Learning and the EMA Group

The difference in average math learning achievement was tested using the t-test and Mann-Whitney U for inferential analysis. According to the results of the prerequisite test analysis with the normality test, the overall learning with the CPA approach comes from data that is not normally distributed. In contrast, the achievement of students' mathematics learning outcomes comes from data normally distributed for students who study with conventional learning. The Mann-Whitney U test is employed to determine the average difference because one of the samples contains data on learning outcomes that are not normally distributed. Table 4 provides a recapitulation of test findings for variations in the specific accomplishment of students' mathematics learning outcomes depending on the overall learning evaluated:

Table 4. Recapitulation of the Average Difference Test of Achievement of Mathematics Learning Outcomes in Overall Review

Learning	***Mann-Whitney U***	***Z***	***p-value* (*sig.*1-tailed)**	**Note**
CPA Conventional	1203,000	-3,027	0,001	H_0 rejected

The average p-value (sig.1-tailed) attainment of the mathematical learning outcomes is 0.001 0.05, which means that H_0 is rejected based on the calculation findings in Table 4. When taken as a whole, the CPA approach significantly outperforms conventional learning in helping students meet their mathematical learning objectives.

Then an analysis is carried out regarding the average difference in mathematics learning outcomes reviewed based on EMA (High, Medium, and Low). Based on the results of the normality test, data on achievement of mathematics learning outcomes, in general, had a p-value (sig.2-tailed) <0.05 in both studies for each EMA group so that H_0 was rejected (data not normally distributed), except for the achievement of learning outcomes reviewed from the high EMA group for students taking CPA and conventional learning the p-value (sig.2-tailed) > 0.05 so that H^0 is accepted (data normally distributed). Due to this, a homogeneity test of variance was conducted for data on learning outcomes in both investigations for the high EMA group. However, a quick non-parametric test, the Mann-Whitney Test, was used for the medium and low EMA groups. The high EMA group in both trials achieved the learning outcomes with a p-value (sig.2-tailed) better than 0.05. Therefore, H_0 is accepted (data are normally distributed), and the Levene test performs the homogeneity test of variance attainment of mathematical learning outcomes.

According to the Levene test's findings, H0 is disproved since the high EMA group has a p-value (sig.2-tailed) lower than 0.05. As a result, it may be said that the two populations' variance is not homogenous. After that, the high EMA group will be the subject of a t'-test. Table 5 summarizes test findings for the distinction in specific student accomplishment concerning the high EMA group as follows:

Table 5. Recapitulation of the Average Difference Test for Mathematics Learning Outcomes in terms of High EMA

t' Test	**EMA**	**Learning**	$\bar{x}$	t_{count}	*df*	t_{table}	***p-value* (*sig*.1-tailed)**	**Note**
Achievement	High	CPA Conventional	15,0625 15,6000	0,410	22,162	2,074	0,343	H_0 accepted

When the p-value (sig.1-tailed) for the accomplishment of mathematical learning outcomes in the high EMA group is > 0.05, as shown by the data in Table 5, H_0 is accepted. As a result, for the high EMA group, students who study using the CPA technique attain mathematics learning outcomes that are considerably different from those of learners who study using conventional methods. Following that, Table 6 shows the findings of the computation of the difference test on the average accomplishment of students' mathematical learning outcomes examined by the medium and low EMA:

Table 6. Recapitulation of the Average Difference Test of Achievement of Mathematics Learning Outcomes in terms of Medium and Low EMA

Mann Whitney U test	**EMA**	**Learning**	***Mann-Whitney U***	***Z***	***p-value* (*sig*.1-tailed)**	**Note**
Achievement	Medium	CPA Conventional	418,500	-2,724	0,003	H_0 rejected
	Low	CPA Conventional	20,500	-2,241	0,012	H_0 rejected

If the p-value (sig.1-tailed) is less than 0.05 and the data in Table 6 show that both studies' EMA accomplishment is moderate or low, then H_0 is rejected. Therefore, for the medium and low EMA groups, students who use the CPA approach obtain mathematical learning results much better than those who use conventional methods. Thus, it can be concluded that, except for high EMA achievement, students who received instruction using the CPA approach significantly outperformed those who got instruction using the conventional method in terms of their accomplishment of mathematical learning outcomes.

Based on a descriptive analysis of the research's findings, it is known that students who study using the CPA approach do better on mathematics learning outcomes than students who study conventionally. An inferential analysis of the research's findings also supports this finding. In conclusion, except for high accomplishment, the attainment of mathematics learning outcomes by students who received instruction using the CPA technique was considerably higher than that of students who received instruction using the traditional method and the EMA group.

Based on the EMA group, calculating the accomplishment of students' mathematical learning outcomes reflects nearly the same situation. Namely, when viewed as a whole and the EMA group, the effectiveness of students' mathematical learning outcomes participating in CPA learning is not statistically different from that of students getting conventional learning, except for moderate achievement. This indicates that overall, and for the EMA group, the implementation of CPA learning had a more significant impact on student mathematics learning results than the adoption of traditional learning. These findings align with research showing that students who study using the CPA methodology achieve higher marks than those who learn using more traditional methods. (Witzel, 2005). Results from sixth-grade primary school students showed that these learners had strong math skills. Students who used a realistic mathematics learning strategy produced more significant results in math than those who used traditional learning methods. However, the learning outcomes of students who use conventional learning methods are superior to those who use practical mathematics learning methods for those with weak numerical aptitude (Sunarthi, Dantes, & Tika, 2015). Because both systems encourage contextual learning in students, there are not many differences between the CPA and RME strategies.

The stages in CPA learning gave students a chance to comprehend the subject matter being taught more effectively and thoroughly, which is why their attainment of the mathematical learning outcomes was much higher than that of students who received conventional instruction. According to research, utilizing the CPA approach to study can serve as a teacher's reference guide for applying effective, efficient, and enjoyable learning techniques. In addition, the CPA approach can enhance student learning results and increase students' self-confidence (Wahyudy, Putri, & Muqodas, 2019; Yuliyanto, Putri, & Rahayu, 2019). The CPA technique can enhance students' mathematical skills and increase mathematics learning results, as discovered in this study and prior studies. The CPA method is an option for raising high school teachers' spatial awareness of their high, medium, and low beginning mathematics abilities (Yulia & Putri, 2021). Beginning with handling tangible items, the learning process moves on to pictures, such as imagining geometric forms and then to the abstract stage. In particular, mathematical topics are symbolically portrayed to aid students in remembering the notions presented. Students can comprehend concepts through their mental models. Students improve their mathematics learning results across the stages of the CPA method by using the best CPA learning strategy, as opposed to those who obtain conventional learning. For school children, learning activities that start with handling tangible things allow them to connect the mathematical concepts they are learning with real-world situations. For elementary school students, learning activities that start with handling tangible things allow them to connect the mathematical concepts they are learning with real-world situations. (Putri, Rahayu, Saptini, & Misnarti, 2016).

The learners' achievement of the mathematical learning objectives is still insufficient, even using the CPA approach. Where are the learners' mathematics learning results when considered overall and EMA. Students who receive instruction using the CPA method perform better on arithmetic learning objectives than conventional instruction. Even if the two learning groups' success standards were still in the moderate range. Due to students' habit of participating in learning by following instructor directions and their continued inability to learn utilizing novel teaching methods like the CPA approach, students' mathematics learning outcomes are still not being met to their full potential. The children in the high EMA group continued to have the highest math performance results.

Meanwhile, the EMA group is in the second position, and the low EMA group is in the lowest position. In line with the implementation of new learning that has not been maximized, research says this is considered reasonable because to switch to a learning approach that has just been introduced to students, of course, the teacher must prepare well. So that in action 1, some students were still confused about the group arrangements, and there was even a commotion when dividing the groups. Because of this, some learners cannot grasp the teacher's directions because they cannot hear the teacher's voice. Likewise, it appears that some students are less active in questioning. Thus, in implementing the first action, the students were less enthusiastic in the learning process (Junaedi, Rosinar, & Sagita, 2019).

The findings from the daily diaries of students from the low and medium EMA groups about the use of manipulatives in instruction are as follows:

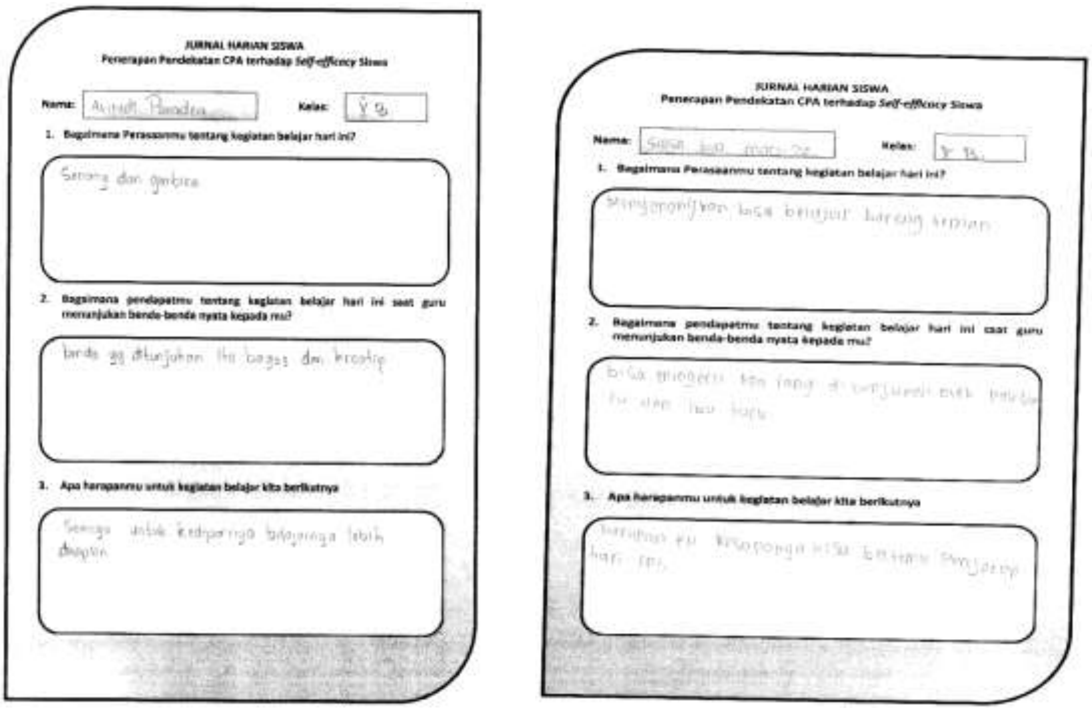
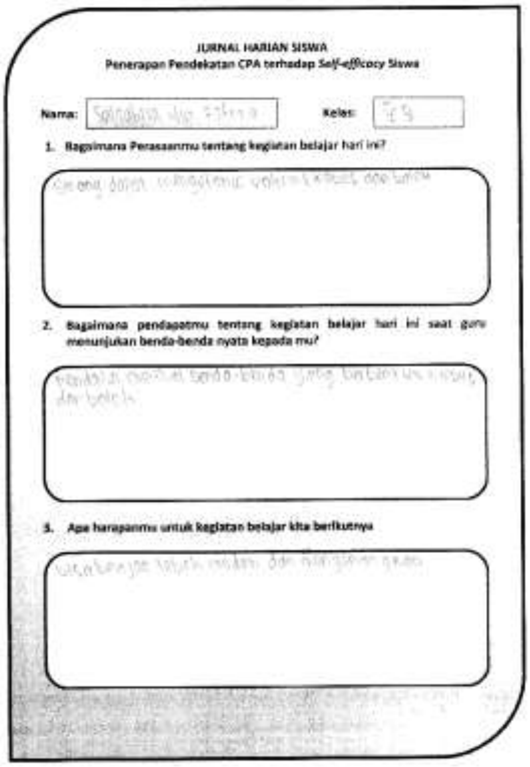


Figure 3. Daily Journal of Mathematics Learning Outcomes of EMA Higher Students


JURNAL HARIAN SISWA
Penerapan Pendekatan CPA terhadap *Self-efficacy* Siswa

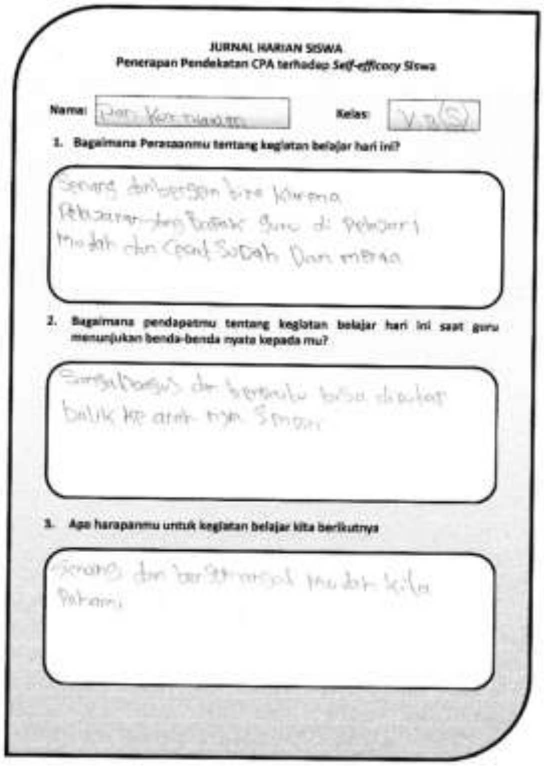
Nama: Kelas:

1. Bagaimana Perasaanmu tentang kegiatan belajar hari ini?

2. Bagaimana pendapatmu tentang kegiatan belajar hari ini saat guru menunjukan benda-benda nyata kepada mu?

3. Apa harapanmu untuk kegiatan belajar kita berikutnya

Figure 4. Journal of Mathematics Learning Outcomes of Moderate EMA Students


JURNAL HARIAN SISWA
Penerapan Pendekatan CPA terhadap *Self-efficacy* Siswa

Nama: Kelas:

1. Bagaimana Perasaanmu tentang kegiatan belajar hari ini?

2. Bagaimana pendapatmu tentang kegiatan belajar hari ini saat guru menunjukan benda-benda nyata kepada mu?

3. Apa harapanmu untuk kegiatan belajar kita berikutnya

Figure 5. Daily Journal of Low EMA Students' Mathematics Learning Outcomes

Based on the journal analysis in Figures 1, 2, and 3, students feel more assisted in understanding mathematical concepts with the opportunity to learn with concrete objects and explore directly, visualize in the form of images, directly manipulate concrete objects and then try to create images from object manipulation to solidify the understanding of the mathematical content they get. The findings of this study demonstrate that CPA learning has a more significant impact and influence than conventional learning, although students' accomplishment of their mathematical learning outcomes is still not perfect. According to studies, one benefit of using the CPA technique is that students can comprehend the learning objective. Consequently, the application will benefit students when combined with the appropriate processes beginning with the tangible, pictorial, and abstract stages (Arvianto & Masduki, 2011).

According to the many issues raised, CPA learning may be a substitute that can be utilized to enhance student learning results in mathematics. It is essential to have an appropriate time and be as effectively designed to describe the content provided at each stage of CPA learning and to manage the learning process in class in order to get the maximum achievement of students' mathematics learning outcomes through the application of CPA learning in the classroom (concrete, pictorial, abstract). The employment of various manipulatives challenges students' mindsets. Attention must be devoted to creating a favorable and enjoyable learning environment for appropriate elementary school students in order to prevent students from being stuck in dull, repetitive, or playing-oriented learning settings. However, learning activities by playing with concrete objects must be optimized to become an opportunity for students to explore their creative potential. Learning with the play method will encourage children to bring out and increase specific creativity, especially science and math skills (Manurung, Wulan, & Purwanto, 2021; Pitaloka, Dimyati, & Purwanta, 2021).

4. Conclusion

Based on the description and analysis of the results, it is clear that using Concrete-Pictorial-Abstract (CPA) learning techniques can significantly improve fifth-grade elementary school students' mathematics learning outcomes when compared to students who study using conventional methods, both as a whole and in groups of high, medium, early mathematical ability, and low. In order to get the best results in math learning, careful planning is needed regarding the use of concrete media, implementation time, and mathematical content that will be taught to students, as well as a conducive and pleasant learning atmosphere that needs to be a part that must be considered so that students are not trapped in monotonous situations. Alternatively, they are too preoccupied with the game of concrete objects. This research is still limited to discussing students' mathematics learning outcomes descriptively and inferentially. Therefore, further studies are needed to find out the factors that influence it and observe related to the domain of students' attitudes in learning mathematics.

5. Author Contribution

Aan Yuliyanto is in charge of conducting field observations, compiling instruments, conducting research, collecting data, and writing and translating articles. Novi Hidayati is in charge of validating instruments, compiling results, and discussing them to conclusions. Yoesrina Novia is in charge of compiling the background, compiling methods, and analyzing data

6. References

Arvianto, I. R., & Masduki, B. M. (2011). Penggunaan Multimedia Pembelajaran Untuk Meningkatkan Pemahaman Konsep Siswa dengan Pendekatan Instruksional Concrete Representational Abstract (CRA) (PTK Pada Siswa Kelas Xi SMKN 1 Banyudono). *Prosiding Seminar Nasional Matematika Prodi Pendidikan Matematika Universitas Muhammadiyah Surakarta*, 170–179. Diambil dari https://publikasiilmiah.ums.ac.id/bitstream/handle/11617/569/MAK-ILHAM-(170-179).pdf?sequence=1

Chusna, N. L. U., Syahrial, Z., Ibrahim, N., & Albaar, M. R. (2020). Effect of Inquiry Learning Strategies on Student Discrete Mathematics Learning. *5th International Conference on Food, Agriculture and Natural Resources (FANRes 2019)*, *194*(2), 389–392. https://doi.org/10.37010/int.v1i2.135

Darto, D. (2021). Dukungan Guru untuk Kemampuan Komunikasi Matematis siswa dalam Pembelajaran Matematika Realistic Mathematics Education. *Prosiding Seminar Nasional Pascasarjana …*, *4*(1), 141–143. Diambil dari https://proceeding.unnes.ac.id/index.php/snpasca/article/view/837%0Ahttps://proceeding.unnes.ac.id/index.php/snpasca/article/download/837/737

Fajri, M. (2018). Developing High Order Thinking Skill in the Context of Mathematical Learning in Primary School. *Proceeding of The 1st UR International Conference on Educational Sciences*, *1*, 261–266. Diambil dari https://ices.prosiding.unri.ac.id/index.php/ICES/issue/view/552

Hendriana, H. (2014). Membangun Kepercayaan Diri Siswa Melalui Pembelajaran Matematika Humanis. *Jurnal Pengajaran Matematika dan Ilmu Pengetahuan Alam*, *19*(1), 52–60. https://doi.org/10.18269/jpmipa.v19i1.424

Junaedi, H., Rosinar, & Sagita, J. (2019). Meningkatkan Gerak Dasar Melempar Bola Besar Dalam Pembelajaran Pendidikan Jasmani Melalui Pendekatan Saintifik Pada Siswa Kelas V Sekolah Dasar Negeri Julang Kota Bogor Kecamatan Tanah Sareal. *Dinamika Sekolah Dasar*, *1*(1), 1–16. Diambil dari http://sipeg.unj.ac.id/repository/upload/jurnal/79-Article_Text-101-1-10-20190919.pdf

Kaharuddin, A. (2019). Effect of Problem Based Learning Model on Mathematical Learning Outcomes of 6th Grade Students of Elementary School Accredited B in Kendari City. *International Journal of Trends in Mathematics Education Research*, *1*(2), 43–46. https://doi.org/10.33122/ijtmer.v1i2.14

Kamaluddin, M., & Widjajanti, D. B. (2019). The Impact of Discovery Learning on Students' Mathematics Learning Outcomes. *Journal of Physics: Conference Series*, *1320*(1), 012038. https://doi.org/10.1088/1742-6596/1320/1/012038

Lesthary, D., Tampubolon, B., & Salimi, A. (2014). Peningkatan Hasil Belajar Siswa pada Pembelajaran Matematika Menggunakan Media Dakon Bilangan di SD. *Jurnal Pendidikan dan Pembelajaran Untan*, *3*(11), 1–15. Diambil dari https://core.ac.uk/download/pdf/196255896.pdf

Lutfi, S., Faelasofi, R., & Nihayati. (2022). Implementation of wahdah method on the mathematics learning. *Desimal: Jurnal Matematika*, *4*(2), 217–224. https://doi.org/10.24042/djm.v4i2.8868

Maloku, V., Ebner, M., & Ebner, M. (2018). A mobile application for school children controlled by external bluetooth devices. *International Journal of Interactive Mobile Technologies*, *12*(5), 81–96. https://doi.org/10.3991/ijim.v12i5.8961

Manurung, A. K. R., Wulan, S., & Purwanto, A. (2021). Permainan Outdoor dalam Membentuk Kemampuan Ketahanmalangan pada Anak Usia Dini. *Jurnal Obsesi : Jurnal Pendidikan Anak Usia Dini*, *5*(2), 1807–1814.

https://doi.org/10.31004/obsesi.v5i2.1030
Marliani. (2021). Matematika Dalam Aksiologi. *Jurnal Pendidikan Guru Sekolah Dasar*, *7*(1), 26–31. Diambil dari https://journal.umpr.ac.id/index.php/tunas/article/view/2862/2158
Miftachurohmah, N., Nasruddin, N., Jahring, J., Sugiarto, A., Anasi, P. T., & Syarifuddin, S. (2022). Implementation of the Creative Problem Solving (CPS) Learning Model Based on Information and Communicaton Technologies (ICT) to Improve Mathematics Learning Outcomes. *Prisma Sains : Jurnal Pengkajian Ilmu dan Pembelajaran Matematika dan IPA IKIP Mataram*, *10*(4), 872–880. Diambil dari https://e-journal.undikma.ac.id/index.php/prismasains/article/view/5828
Munir, Misbahul, A., Murtono, & Darmanto, E. (2022). The Influence of Quizizz-assisted Teams Games Tournament on Mathematics Learning Outcomes for Grade V Elementary School. *ANP Journal of Social Sciences and Humanities (ANP-JSSH)*, *3*(2), 85–89. Diambil dari https://journalarsvot.com/index.php/anp-jssh/article/view/272
Murtiyasa, B., & Al Karomah, I. I. (2020). The impact of learning strategy of problem solving and discovery towards learning outcomes reviewed from students learning motivation. *Universal Journal of Educational Research*, *8*(9), 4105–4112. https://doi.org/10.13189/ujer.2020.080936
Nuansa, D. S., & Khasanah, U. (2017). Relationship Between How To Learn, Mathematic Communication, and Learning Facilities With Results of Mathematics Students in SMP Muhammadiyah 4 Yogyakarta. *AdMathEduSt: Jurnal Ilmiah Mahasiswa Pendidikan Matematika*, *4*(6), 298–301. https://doi.org/10.12928/admathedust.v4i6.16387
Nurhayani, N., & Hapsan, A. (2019). Effect of The Model Application Setting Interactive Learning Cooperative Learning with Concern Interest And Capability to Initial Student Learning Outcomes Grade X MIA SMA State 2 Pangkajene. *Matematika dan Pembelajaran*, *7*(2), 1–12. https://doi.org/10.33477/mp.v7i2.1151
Oktafianti, R. I., Purwoko, R. Y., & Astuti, E. P. (2019). Pengembangan Model Pembelajaran Matematika Berbasis Budaya Melalui Permainan Tradisional Jawa. *Jurnal Inovasi Pendidikan Matematika*, *1*(1), 29–40. Diambil dari https://jurnal.umpwr.ac.id/index.php/jipm/article/view/1027/777
Pitaloka, D. L., Dimyati, D., & Purwanta, E. (2021). The Role of Teachers in Instilling the Value of Tolerance in Early Childhood in Indonesia. *Journal of Obsession: Journal of Early Childhood Education*, *5*(2), 1696–1705.
Purdiyanto, P., Sasongko, Nur, R., Kristiawan, Muhammad, Walid, … Tamrin, R. G. (2021). Influence of Demonstration Methods and Student's Activity on Learning Outcomes. *Education Quarterly Reviews*, *4*(2), 91–99. https://doi.org/10.31014/aior.1993.04.02.200
Putri, H E, Yuliyanto, A., Nikawanti, G., Rahayu, P., & Majid, N. W. A. (2020). Concrete pictorial abstract approach to the improvement of elementary school students' self efficacy mathematics. *International Conference on Mathematics*

and Science Education of Universitas Pendidikan Indonesia, *4*, 25–31. Diambil dari http://science.conference.upi.edu/proceeding/index.php/ICMScE/article/view/212

Putri, Hafiziani Eka, Rahayu, P., Saptini, R. D., & Misnarti. (2016). Keterkaitan Penerapan Pendekatan Cpa Dan Peningkatan Kemampuan Koneksi Matematis Siswa Sekolah Dasar. *Metodik Didaktik*, *11*(1), 41–49. https://doi.org/10.17509/md.v11i1.3785

Putri, Hafiziani Eka, Suwangsih, E., Rahayu, P., Nikawanti, G., Enzelina, E., & Wahyudy, M. A. (2020). Influence of Concrete-Pictorial-Abstract (CPA) Approach on the Enhancement of Primary School Students' Mathematical Reasoning Ability. *Mimbar Sekolah Dasar*, *7*(1), 119–132. https://doi.org/10.17509/mimbar-sd.v7i1.22574

Ratnasari, D. A., Agung, A. A. G., & Sudatha, I. G. W. (2021). Development of Mathematics Interactive Multimedia on Third Grade Elementary School Students. *Proceedings of the 2nd International Conference on Technology and Educational Science (ICTES 2020)*, *540*(Ictes 2020), 195–199. https://doi.org/10.2991/assehr.k.210407.268

Rhosyida, N., Trisniawati, & Muanifah, M. T. (2020). Self-Assessment Through Diary Book for Elementary Students. *Proceedings of the SEMANTIK Conference of Mathematics Education (SEMANTIK 2019)*, *467*(Semantik 2019), 104–109. https://doi.org/10.2991/assehr.k.200827.126

Safitri, T. R., & Trimurtini, T. (2020). The Effectiveness of the Standard Media Assisted CTL Model on Mathematics Learning Outcomes. *Elementary School Teacher*, *4*(1), 1–5. Diambil dari https://journal.unnes.ac.id/nju/index.php/est/article/view/29011

Saputra, D. S., Yuliati, Y., & Rachmadtullah, R. (2019). Use of ladder snake media in improving student learning outcomes in mathematics learning in elementary school. *Journal of Physics: Conference Series*, *1363*(1). https://doi.org/10.1088/1742-6596/1363/1/012058

Sarjono, S. (2021). Peningkatan Hasil Belajar Matematika Tentang Luas Permukaan Dan Volume Bangun Ruang Sisi Datar Dengan Model Pembelajaran Team Assisted Individualization. *PHI: Jurnal Pendidikan Matematika*, *5*(2), 149–155. https://doi.org/10.33087/phi.v5i2.150

Sugiyono. (2017). *Statistika untuk Penelitian*. Bandung: Alfabeta.

Suherlan, N. K., Khuzaini, N., & Marhaeni, N. H. (2022). Deskripsi Kebutuhan Pembelajaran Daring Menggunakan Platform Gather Town untuk Meningkatkan Hasil Belajar Matematika Siswa. *Jurnal Pendidikan Matematika*, *10*(1), 83–92. https://doi.org/10.23960/mtk/v10i1.pp83-92

Suherman, E., & Kusumah, Y. S. (1990). *Petunjuk Praktis untuk Melaksanakan Evaluasi Pendidikan Matematika*. Bandung: Wijayakusumah 157.

Sunarthi, N. W., Dantes, N., & Tika, I. N. (2015). Pengaruh Pendekatan Pembelajaran Matematika Realistik Terhadap Hasil Belajar Matematika Siswa Sekolah Dasar Ditinjau Dari Kemampuan Numerik Pada Siswa Kelas Vi

Gugus Sukawati III. *Jurnal Penelitian dan Evaluasi Pendidikan*, *5*(1), 1–10. Diambil dari https://ejournal-pasca.undiksha.ac.id/index.php/jurnal_ep/article/view/1576

Umboh, D., Tarusu, D., Marini, A., & Sumantri, M. S. (2021). Improvement of student mathematics learning outcomes through Kahoot learning games application at elementary school. *Journal of Physics: Conference Series*, *1869*(1). https://doi.org/10.1088/1742-6596/1869/1/012124

Wahyudy, M. A., Putri, H. E., & Muqodas, I. (2019). Penerapan Pendekatan Concrete-Pictorial-Abstract (CPA) dalam Menurunkan Kecemasan Matematis Siswa Sekolah. *Simposium Nasional Ilmiah & Call for Paper Unindra (Simponi).*, (November), 228–238. https://doi.org/10.30998/simponi.v0i0.428

Widoyoko, S. E. (2017). *Teknik Penyusunan Instrumen Penelitian*. Yogyakarta: Pustaka Pelajar.

Witzel, B. (2005). Using CRA to Teach Algebra to Students with Math Difficulties in Inclusive Settings. *Learning Disabilities: A Contemporary Journal*, *3*(2), 49–60. Diambil dari https://eric.ed.gov/?redir=http%3A%2F%2Fwww.ldam.org%2Fpublications%2Fcontemporary%2F09-05_TOC.html

Yanse, F. (2020). Peningkatan Hasil Belajar Matematika melalui Pembelajaran Matematika Realistik pada Siswa Kelas VI SD Negri Kembaran Kecamatan Candimulyo Magelang. *Warta Pendidikan*, *5*(3), 32–36. Diambil dari http://jurnal.warta-pendidikan.com/ojs/index.php/WP/article/view/85/85

Yulia, E. N. R., & Putri, H. E. (2021). Penerapan Pendekatan Concrete-Pictorial-Abstract (CPA) untuk Meningkatkan Spatial Sense Siswa SD. *Indonesian Journal of Primary Education*, *5*(1), 50–62. https://doi.org/https://doi.org/10.17509/ijpe.v5i1.31894

Yuliyanto, A., Fadriyah, A., Yeli, K. P., & Wulandari, H. (2018). Pendekatan Saintifik untuk Mengembangkan Karakter Disiplin dan Tanggung Jawab Siswa Sekolah Dasar. *Metodik Didaktik*, *13*(2), 87–98. https://doi.org/10.17509/md.v13i2.9307

Yuliyanto, A., Putri, H. E., & Rahayu, P. (2019). Peningkatan Hasil Belajar Siswa SD melalui Pendekatan Concrete-Pictorial-Abstract (CPA). *Metodik Didaktik*, *14*(2), 75–83. https://doi.org/10.17509/md.v14i2.13537

Yuliyanto, A., Turmudi, Agustin, M., Muqodas, I., & Putri, H. E. (2020). The Relationship of Self Efficacy With Student Mathematics Learning Outcomes through The Concrete-Pictorial-Abstract (CPA) Approach in Primary Schools. *JPSd: Jurnal Pendidikan Sekolah Dasar*, *6*(1), 1–14. https://doi.org/http://dx.doi.org/10.30870/jpsd.v6i1.7213

Yuliyanto, A., & Turmudi, T. (2020). Study Based on the Early Mathematical Ability of Elementary Student Self-efficacy through the Concrete-Pictorial-Abstract Approach. *Universal Journal of Educational Research*, *8*(11B), 5901–5912. https://doi.org/10.13189/ujer.2020.082224