PRISMA, 13(1), 103-112, June 2024
https://jurnal.unsur.ac.id/prisma
DOI:10.35194/jp.v13i1.3947

p-ISSN 2089 3604
e-ISSN 2614 4611

Research Trends on Learning Mathematics with The CPA (Concrete-Pictorial-Abstract) Approach

Jasmine Salsabila Lutfi[1,*], Dadan Dasari[2]
[1,2]Universitas Pendidikan Indonesia, Bandung
*Corresponding Author: jasmines.salsabila@upi.edu

Submitted: 27-12-2023	*Revised: 10-06-2024*	*Accepted: 15-06-2024*	*Published: 30-06-2024*

ABSTRACT

Learning mathematics with the CPA approach has been practiced in Singapore and proven its effectiveness. However, there needs to be a synthesis of previous studies to find research gaps for future research. This article is a preliminary-research for information on the CPA approach and its modifications to mathematical abilities and attitudes. This article is a Systematic Literature Review (SLR) of 39 studies published from 2010 to April 2023 using the Publish or Perish application with the Scopus database. This article aims to find out: (1) Description of mathematics education research trends using the CPA approach in terms of publication year, author, country, level of education, and mathematics content. (2) Application of the CPA approach to the type of mathematical ability and attitude of students. The results showed that research outside the elementary school level needs further investigation. Abstract mathematical concepts require a CPA approach. The CPA approach has a positive effect on students with or without learning disabilities or at risk of failure. Results and suggestions for future research on this topic are provided.

Keywords: CPA; concrete-pictorial-abstract; SLR; systematic literature review

INTRODUCTION

One of the compulsory subjects for 12 years of formal education in Indonesia from elementary to high school is mathematics. According to Yeh et al. (2019), mathematics is a fundamental subject because aspects of arithmetic and logical reasoning are the basis for the development of science and technology. Mathematics is one of the basic sciences needed for reasoning, developing the ability to think systematically and logically, solve problems in everyday life, and communicate ideas that are needed in the development of science and technology (Umar et al., 2022). From the description above, mathematics is a fundamental lesson for students to practice their mathematical thinking skills in preparing themselves to face the changing times.

Mathematics consists mostly of abstract objects (Saleh et al., 2018). Because it is abstract, often teachers and students experience several obstacles in the learning process. In fact, students do not like mathematics because it is considered the most difficult subject among other subjects (Pulungan &; Rakhmawati, 2022; Heyder et al., 2020; Bishara, 2018). Because mathematical objects are abstract, mathematics requires representation (Minarni &; Napitupulu, 2017). Since the object is abstract in mathematics, the teacher needs to choose the right mathematical approach so that students can understand abstract mathematical concepts and can finally represent them as problem-solving answers.

One approach that supports students' learning from non-symbolic to abstract skills is the CPA (Concrete-Pictorial-Abstract) learning approach that has been practiced in

Singapore (Kurniawan et al., 2020). The CPA approach in some literature is also known as CRA (Concrete-Representational-Abstract) or CSA (Concrete-SemiConcrete-Abstract) (Hafiziani Eka Putri et al., 2016). The CPA approach is learning that starts from solving mathematical problems with the support of concrete objects, then moves to solving problems with pictures, until students learn to solve problems abstractly without the support of concrete objects (E. Bouck et al., 2017). With the CPA approach, students can build their understanding. According to Witzel (in Salimi et al., 2020), CPA uses hierarchical stages that provide opportunities for students to reconstruct their knowledge.

The CPA approach is based on Bruner's (1966) stage which shows that children develop knowledge through three stages of representation, namely the enactive, iconic, and symbolic stages (Peltier &; Vannest, 2018). According to Bruner (in Shafiee & Meng, 2021), Enactive representation means learning through motor actions, iconic representation means learning through image perception, and symbolic representation means learning through symbols. Thus, Bruner's three stages of representation in the CPA approach are aligned through the concrete stage in enactive representation, the pictorial stage in iconic representation, and the abstract stage in symbolic representation.

Many studies (such as Milton et al., 2023; AL-salahat, 2022; Flores et al., 2020; Mahayukti et al., 2019; Flores et al., 2018) which showed significant improvements in mathematics learning with CPA approaches at various levels. Of the many studies, it is necessary to carry out a synthesis in order to know how far the CPA approach research has been carried out, and to find research gaps for further research. This research is different from Azzumar & Juandi (2023), where the article search aspect was from 2018 to 2022 which examined the application of the CPA approach to mathematics learning outcomes, mathematical abilities, and mathematical attitudes in terms of research year and research level. Meanwhile, in this article, the study was carried out from 2010 to April 2023 which also examined mathematics content and modifications to the CPA approach. For more details, the research objectives in this article are:

1. Describe mathematics education research trends using the CPA approach in terms of publication year, author, country, school level, and mathematics content.
2. Describe the results of applying the CPA approach to students' mathematical abilities and attitudes.

RESEARCH METHODS

This study used the Systematic Literature Review (SLR) method. The purpose of SLR is to collect secondary data collected from research results related to the application of the CPA approach in mathematics learning. There are three main stages in SLR research, namely review planning, review implementation, and review reporting (Xiao &; Watson, 2019). In the review planning stage, researchers identify review needs, define research questions, and develop review protocols. At the implementation stage of the review, the researcher selects the necessary research articles, extracts, analyzes and synthesizes the data. Finally, at the review reporting stage, researchers write reports to disseminate the findings of the literature review.

The following is a set of inclusion criteria established to determine review limits: (1) The study discusses the application of the CPA approach to mathematics learning. (2) Scopus indexed. (3) Articles published until April 2023 (the last month of article search). (4) Focus on articles reporting empirical findings based on quantitative, qualitative, or mixed methods. Thus, theoretical articles and literature reviews are eliminated. (5) The article is published in English.

This research uses the Scopus database and data collection techniques using the Publish or Perish (PoP) application. In the main study selection process, the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyzes) protocol was used. PRISMA refers to four stages, including identification, screening, eligibility, and included (Moher et al., 2009). The stages of literature search with PRISMA flow charts are presented in Figure 1. Based on Figure 1, at the initial search identification stage with the keyword "concrete AND representational OR pictorial OR semi concrete AND abstract [title]" there were 43 studies.

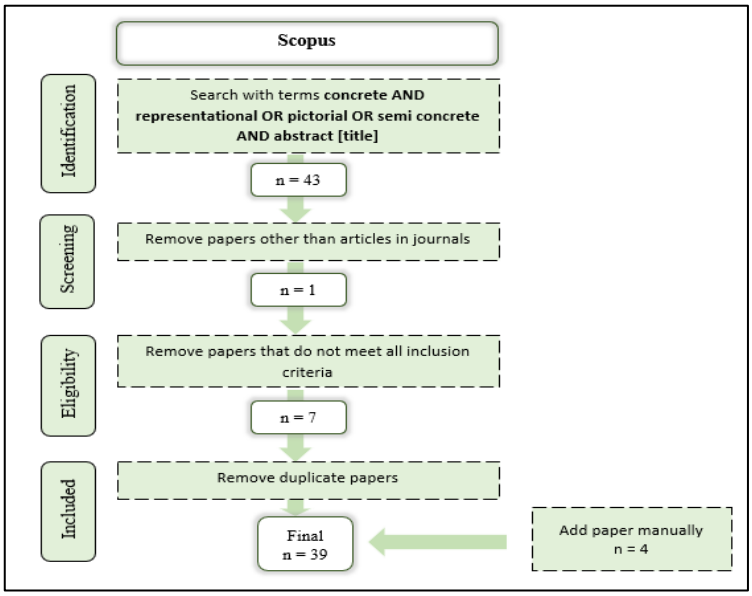

Figure 1. Diagram alir PRISMA

In the screening stage, one paper is eliminated in the form of a book. At the eligibility stage, seven papers that did not meet the inclusion criteria were eliminated with five not related to mathematics learning and two in the form of literature review. In the included stage, researchers added four studies that met the inclusion criteria manually. Thus, there are 39 articles to be identified in this study. The researchers manually examined the 39 articles by reviewing them using Ms. Excel.

RESULT AND DISCUSSION

Description of Research Trends in Mathematics Learning with CPA Approach

Study by year of publication

The search for articles in this SLR is not limited to the lower limit of the research year because the researcher wants to know the extent of the research has been done. Based on final search results that meet the inclusion criteria, the first published articles were found to be from 2010 to 2023. The amount of published research related to the CPA approach in

mathematics learning fluctuates between 2010 and April 2023. Studies on the application of the CPA approach to mathematics learning were most published in 2020 with a total of nine studies. Then in 2021 the number of publications decreased drastically and rose again in 2022 with six publications.

Study by author

Based on 39 studies on mathematics learning using the CPA approach, there were 64 authors who participated. The following are the three authors with the most studies:

Table 1. Authors with the Highest Number of Studies

Author	Country	Total
Margaret M. Flores, PhD, BCBA-D	United States	17
Vanessa M. Hinton, PhD	United States	14
Jill M. Meyer, PhD, LCPC, CRC	United States	4

*One study may consist of multiple authors.

From Table 1, the three authors are from the Department of Special Education, Rehabilitation, and Counseling at Auburn University, USA. The origin of the department of the three authors is related to the CPA approach. This is because CPA has been widely applied to students with learning disabilities or learning disabilities. Research on the application of the CPA approach to mathematics learning shows positive outcomes for students with disabilities (Milton et al., 2023; Kaya &; Yildiz, 2023) and students without disabilities (Kurniawan et al., 2020; Yuliyanto &; Turmudi, 2020). The distribution of CPA learning to students with learning disabilities can be seen in Table 3.

Study by country

Based on 39 studies on mathematics learning with the CPA approach consisting of eight authors' countries. Details regarding the number of studies by country are presented in Table 2.

Table 2. Number of Studies by Country.

Country	United States	Indonesia	Turkish	China	Malaysia	Filipina	Arab Saudi	South Africa
Total	25*	8	2	1*	1	1	1	1

*There was one study consisting of 2 countries.

From Table 2, the highest number of studies came from the United States. Then followed by Indonesia and Turkey. Studies in the US were dominated by Auburn University with 17 studies. Meanwhile, Indonesia is dominated by the Universitas Pendidikan Indonesia with 4 studies.

Study by school level

Based on 39 studies that met the inclusion criteria, research on the application of the CPA approach varied at the education level. Details regarding the distribution of education levels are presented in Table 3. Based on Table 3, the majority of research publications on the Concrete-Pictorial-Abstract (CPA) approach are conducted at the primary school level. Based on Piaget's stages of cognitive development, primary school students are at a concrete stage of operational development. In that phase, children use concrete thinking to solve problems (Hamilton & Ghatala, 1994). Thus, the CPA approach helps elementary school

students to learn and solve mathematical problems ranging from the transformation of the concrete stage to the abstract stage.

Table 3. Study by School Level.

School Level	TK	SD	SMP	SMA	University	Teacher	Special Schools
Subjects with learning disabilities	1	24	2	0	0	0	1
Subjects without learning disabilities	0	7	3	0	1	1	-

Based on Table 3, the school levels where no research has been carried out on subjects with learning disabilities are senior high school, university, and teacher level. Meanwhile, for subjects without learning disabilities, there has been no research at the kindergarten and senior high school levels. For senior high school level, there have been no studies that have been published. This can open up new research opportunities at levels that are still not widely researched other than elementary school.

Studies based on mathematical content

Based on 39 studies that meet the inclusion criteria, the use of the CPA approach has been practiced on several mathematical content. Details of the distribution of mathematical content with the CPA approach are presented in Table 4.

Table 4. Studies based on Mathematical Content.

Math Content	Total	Math Content	Total
Addition	7	Division	1
Fractions	7	Expanded Notation	1
Subtraction	6	Factoring	1
Geometry	6	Multiplication with partial products algorithm	1
Subtraction with regrouping	4	Number comparison	1
Algebra	3	Place value	1
Multiplication	3	Special products	1
Multiplication with regrouping	2	Statistic	1
Rounding	2	Time and money	1
Addition with regrouping	1	Not mentioned	3

* One study may consist of several materials

Based on Table 4, the most mathematical content in research on the application of the CPA approach is about addition and fractions. The CPA approach has proven effective for recovering deficits in basic mathematical calculations, place values, fractions, and algebra (Flores, 2010). Basic materials such as number operations, fractions, and geometry are important for students to master because they are related to advanced mathematical content at the junior high school to university level.

Application of CPA Approach to Students' Mathematical Abilities and Attitudes

Based on 39 studies that met the inclusion criteria, the use of the Concrete-Pictorial-Abstract (CPA) approach was studied in several aspects of mathematical ability and attitude. Details regarding distribution are presented in Table 5. The results of applying the CPA approach in mathematics learning have proven effective against the mathematical attitudes of students without learning disabilities, namely: self-efficacy (Yuliyanto &; Turmudi,

2020); learning motivation (Kurniawan et al., 2020); and mathematical disposition (Minarti &; Wahyudin, 2019). The CPAAG (Concrete-Pictorial-Abstract Approach Group) approach is also effective in the mathematical confidence of students without disabilities (Salingay &; Tan, 2018).

Table 5. CPA's Approach to Students' Mathematical Abilities

Variable	Types of CPA	Effective against the subject
Mathematical conceptual understanding.	CPA-I	Subjects with learning disabilities / risk of failure: (Strickland & Maccini, 2013)
	CPA	Subjects with learning disabilities / risk of failure: (Milton et al., 2023). Subjects without learning disabilities: (Minarti &; Wahyudin, 2019).
	CPA-SIM	Subjects with learning disabilities / risk of failure: (Flores & Hinton, 2019).
Procedural fluency.	CPA-I	Subjects with learning disabilities / risk of failure: (Strickland & Maccini, 2013).
	CPA	Subjects with learning disabilities / risk of failure: (Peltier & Vannest, 2018).
Conceptual &; procedural knowledge.	CPA-SIM	Subjects with learning disabilities / risk of failure: (Flores et al., 2014).
	CPA	Subjects with learning disabilities / risk of failure: (Zhang et al., 2022).
Mathematical Representations.	CPA	Subjects without learning disabilities: (Purwadi et al., 2019).
Computational accuracy and fluency.	CPA-SIM	Subjects with learning disabilities / risk of failure: (Miller & Kaffar, 2011).
	CPA	Subjects with learning disabilities / risk of failure: (Flores & Milton, 2020).
Spatial ability.	CPA	Subjects without learning disabilities: (Mahayukti et al., 2019).
Problem solving.	CPA	Subjects with learning disabilities / risk of failure: (Bouck et al., 2017). Subjects without learning disabilities: (Kurniawan et al., 2020)
	CPA-SBI	Subjects with learning disabilities / risk of failure: (Flores et al., 2016)
Mathematical performance.	CPA-I	Subjects with learning disabilities / risk of failure: (V. Hinton & Flores, 2022).
	CPA-SIM	Subjects with learning disabilities / risk of failure: (Flores, Moore, et al., 2020).
	CPA-VBI	Subjects with learning disabilities / risk of failure: (Rushioglu & Avcioglu, 2022).
	CPA	Subjects with learning disabilities / risk of failure: (Kaya & Yildiz, 2023). Subjects without learning disabilities: (Salimi et al., 2020).
	CPA-CLR	Subjects without learning disabilities: (Shafiee &; Meng, 2021).
	CPAAG	Subjects without learning disabilities: (Shown in 2018).

Information:
CPAAG = CPA Approach Group
CPA-I = *CPA Integrated*
CPA-SIM = *CPA with Strategic Instruction Mode*
CPA-SBI = *CPA and Schema-Based Instruction*
CPA-VBI = *CPA with Video-Based Intervention*
CPA-CLR = *CPA with Collaborative Lesson Research*

As for students with learning disabilities or have a risk of failure, the CPA approach has been shown to be effective on students' mathematical confidence (Flores, 2010), and EL-CPA (CPA-based Experiential Learning) is effective on mathematical attitudes in general in students with learning disabilities or risk of failure (Amril et al., 2020) This study will be beneficial for future research as it will provide an overview of trends in studies of the application of the CPA approach, and the research gaps from previous studies.

Based on Table 5, the CPA approach is widely used for students with disabilities or at risk of failure. Students with learning disabilities or at risk of failure usually take longer to master a given learning objective. Teachers need to include aspects of visual representation for abstract mathematical concepts. The CPA is a practical teaching framework with evidence to support its use across classrooms, content areas in mathematics, and various learning disabilities (Peltier &; Vannest, 2018). In experiential learning using object manipulation in the CPA approach, the level of mental maturity of students is formed so that they are able to establish relationships between concrete objects and mathematical formulas (Ruştioğlu &; Avcıoğlu, 2022). Thus, it can help students with disabilities or at risk of failing to understand concepts that are key to solving math problems.

Further research is expected to examine at the school level other than elementary school, for example junior high school students. This is because, according to Piaget's stage of cognitive development, junior high school students (over 11 years old) are in the formal operational stage (Hamilton & Ghatala, 1994). However, junior high school teachers still need to consider the operational level before formal because junior high school students sometimes have not reached the stage of formal or abstract thinking (Widodo & Wahyudin, 2018). Teachers can use the CPA approach for basic or advanced mathematics material, especially for students who have learning disabilities or students who have a risk of failure.

CONCLUSION

From the systematic literature review (SLR) of 39 articles meeting the inclusion criteria, it's evident that the Concrete-Pictorial-Abstract (CPA) approach in mathematics education has seen a prominent research trend, with the highest publication rate in 2020. Margaret M. Flores, Ph.D., BCBA-D emerged as the most prolific author, contributing 17 articles. The United States stands out as the leading country in terms of publications on this approach. Primary schools are dominant for students with or without learning disabilities or at risk of failure. Notably, addition, fractions, subtraction, and geometry emerged as the most researched mathematics content, which lays a foundational basis for subsequent school levels. Further research is expected to be able to examine the application of the CPA approach at levels other than elementary school and advanced mathematics material with a more complete mathematical process. In addition, it is also expected to use modifications of the CPA approach such as CPA-I (CPA-integrated), CPA-SIM (CPA and Strategic Instruction Model), CPA-SBI (CPA and Schema-Based Instruction), CPA-VBI (CPA with Video-Based Intervention), CPA-CLR (CPA with Collaborative Lesson Research), CPAAG (CPA Approach Group), or with EL-CPA (CPA-based Experiential Learning) can be applied and researched further.

REFERENCES

AL-salahat, M. M. S. (2022). The effect of using concrete-representational-abstract sequence in Teaching the perimeter of geometric shapes for students with learning disabilities. *International Journal of Education in Mathematics, Science and Technology*, *10*(2), 477–493. https://doi.org/10.46328/ijemst.2291

Amril, L. O., Darhim, & Juandi, D. (2020). The effect experiential learning model based concrete-pictorial-abstract (EL-CPA) on mathematics attitude of deaf students. *Journal of Physics: Conference Series*, *1657*, 1–6. https://doi.org/10.1088/1742-6596/1657/1/012070

Azzumar, F., & Juandi, D. (2023). Concrete-pictorial-abstract approaches to mathematics education: A systematic literature review. *Journal of Mathematics and Mathematics Education (JMME), 13(1),* 1-11. https://doi.org/10.20961/jmme.v13i1.73962

Bishara, S. (2018). Active and traditional teaching, self-image, and motivation in learning math among pupils with learning disabilities. *Cogent Education*, *5*(1), 1–16. https://doi.org/10.1080/2331186X.2018.1436123

Bouck, E., Park, J., & Nickell, B. (2017). Using the concrete-representational-abstract approach to support students with intellectual disability to solve change-making problems. *Research in Developmental Disabilities*, *60*, 24–36. https://doi.org/10.1016/j.ridd.2016.11.006

Flores, M. M. (2010). Using the concrete-representational-abstract sequence to teach subtraction with regrouping to students at risk for failure. *Remedial and Special Education*, *31*(3), 195–207. https://doi.org/10.1177/0741932508327467

Flores, M. M., & Hinton, V. M. (2019). Improvement in elementary students' multiplication skills and understanding after learning through the combination of the concrete-representational-abstract sequence and strategic instruction. *Education and Treatment of Children*, *42*(1), 73–99. https://doi.org/10.1353/etc.2019.0004

Flores, M. M., Hinton, V. M., & Burton, M. E. (2016). Teaching problem solving to students receiving tiered interventions using the concrete-representational-abstract sequence and schema-based instruction. *Preventing School Failure*, *0*(0), 1–11. https://doi.org/10.1080/1045988X.2016.1164117

Flores, M. M., Hinton, V. M., & Meyer, J. M. (2020). Teaching fraction concepts using the concrete-representational-abstract sequence. *Remedial and Special Education*, *41*(3), 165–175. https://doi.org/10.1177/0741932518795477

Flores, M. M., Hinton, V. M., & Taylor, J. J. (2018). CRA fraction intervention for fifth-grade students receiving tier two interventions. *Preventing School Failure*, *62*(3), 198–213. https://doi.org/10.1080/1045988X.2017.1414027

Flores, M. M., Hinton, V., & Strozier, S. D. (2014). Teaching subtraction and multiplication with regrouping using the concrete-representational-abstract sequence and strategic instruction model. *Learning Disabilities Research and Practice*, *29*(2), 75–88. https://doi.org/10.1111/ldrp.12032

Flores, M. M., & Milton, J. H. (2020). Teaching the partial products algorithm using the concrete-representational-abstract sequence. *Exceptionality*, *28*(2), 142–160. https://doi.org/10.1080/09362835.2020.1772070

Flores, M. M., Moore, A. J., & Meyer, J. M. (2020). Teaching the partial products algorithm with the concrete representational abstract sequence and the strategic instruction model. *Psychology in the Schools*, *57*(6), 946–958. https://doi.org/10.1002/pits.22335

Hamilton, R., & Ghatala, E. (1994). *Learning and Instruction*. McGraw-Hill, Inc.

Heyder, A., Weidinger, A. F., Cimpian, A., & Steinmayr, R. (2020). Teachers' belief that math requires innate ability predicts lower intrinsic motivation among low-achieving students. *Learning and Instruction*, *65*(101220), 1–39.

https://doi.org/10.1016/j.learninstruc.2019.101220

Hinton, V., & Flores, M. (2022). Concrete-representational-abstract–integrated as a tier 2 instruction to teach addition. *Rural Special Education Quarterly*, *41*(3), 169–178. https://doi.org/10.1177/87568705221075756

Kaya, S., & Yildiz, N. G. (2023). Using the concrete–representational–abstract sequence to teach math skills to a student with autism spectrum disorder in a general education classroom. *International Journal of Developmental Disabilities*. https://doi.org/10.1080/20473869.2023.2180539

Kurniawan, H., Budiyono, Sajidan, & Siswandari. (2020). Concrete-pictorial-abstract approach on student's motivation and problem solving performance in Algebra. *Universal Journal of Educational Research*, *8*(7), 3204–3212. https://doi.org/10.13189/ujer.2020.080749

Mahayukti, G. A., Dianawati, N. P. S., Ardana, I. M., & Suryawan, I. P. P. (2019). The effect of concrete-pictorial-abstract learning strategy on spatial sense ability. *Journal of Physics: Conference Series*, *1317*, 1–9. https://doi.org/10.1088/1742-6596/1317/1/012007

Miller, S. P., & Kaffar, B. J. (2011). Developing Addition with Regrouping Competence among Second Grade Students with Mathematics Difficulties. *Investigations in Mathematics Learning*, *4*(1), 24–49. https://doi.org/10.1080/24727466.2011.11790308

Milton, J. H., Flores, M. M., Hinton, V. M., Dunn, C., & Darch, C. B. (2023). Using the concrete-representational-abstract sequence to teach conceptual understanding of place value, rounding, and expanded Nnotation. *Learning Disabilities Research and Practice*, *38*(1), 15–25. https://doi.org/10.1111/ldrp.12299

Minarni, A., & Napitupulu, E. E. (2017). Developing Instruction Materials Based on Joyful PBL to Improve Students Mathematical Representation Ability. *International Education Studies*, *10*(9), 23–38. https://doi.org/10.5539/ies.v10n9p23

Minarti, E. D., & Wahyudin. (2019). Conceptual understanding and mathematical disposition of college student through Concrete-Representational-Abstract approach (CRA). *Journal of Physics: Conference Series*, *1157*, 1–6. https://doi.org/10.1088/1742-6596/1157/4/042124

Moher, D., Liberati, A., Tetzlaff, J., Altman, D. G., & Group, T. P. (2009). Preferred Reporting Items for Systematic Reviews and Meta-Analyses : The PRISMA Statement. *PLoS Medicine*, *6*(7), 1–6. https://doi.org/10.1371/journal.pmed.1000097

Peltier, C., & Vannest, K. J. (2018). Using the concrete representational abstract (CRA) instructional framework for mathematics with students with emotional and behavioral disorders. *Preventing School Failure*, *62*(2), 73–82. https://doi.org/10.1080/1045988X.2017.1354809

Pulungan, A. R., & Rakhmawati, F. (2022). Tren Media Pembelajaran Matematika dalam Jurnal Pendidikan Matematika di Seluruh Indonesia. *Jurnal Cendekia : Jurnal Pendidikan Matematika*, *6*(3), 3443–3458. https://doi.org/10.31004/cendekia.v6i3.1776

Purwadi, I. M. A., Sudiarta, I. G. P., & Supart, I. N. (2019). The effect of concrete-pictorial-abstract strategy toward students' mathematical conceptual understanding and mathematical representation on fractions. *International Journal of Instruction*, *12*(1), 1113–1126. https://eric.ed.gov/?id=EJ1201375

Putri, H. E., 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://ejournal.upi.edu/index.php/MetodikDidaktik/article/view/3785

Ruştioğlu, O., & Avcıoğlu, H. (2022). Comparison of the different presentations of

Concrete-Representational-Abstract (CRA) sequence to teach functional academic skills for students with developmental retardation. *Sustainability*, *14*(10752), 1–19. https://doi.org/10.3390/su141710752

Saleh, M., Prahmana, R. C. I., Isa, M., & Murni. (2018). Improving the reasoning ability of elementary school student through the Indonesian realistic mathematics education. *Journal on Mathematics Education*, *9*(1), 41–54. https://eric.ed.gov/?id=EJ1173650

Salimi, M., Suhartono, S., Hidayah, R., & Fajari, L. E. W. (2020). Improving mathematics learning of geometry through the concrete-pictorial-Abstract (CPA) approach: Collaborative action research. *Journal of Physics: Conference Series*, *1663*, 1–8. https://doi.org/10.1088/1742-6596/1663/1/012046

Salingay, N. R. R., & Tan, D. A. (2018). Concrete-pictorial-abstract approach on students' attitude and performance in mathematics. *International Journal of Scientific and Technology Research*, *7*(5), 90–111. https://www.ijstr.org/final-print/may2018/Concrete-pictorial-abstract-Approach-On-Students-Attitude-And-Performance-In-Mathematics.pdf

Shafiee, M. S., & Meng, C. C. (2021). Impact of concrete-pictorial-abstract approach with collaborative lesson research on year four pupils' proficiency in perimeter. *Pertanika Journal of Social Sciences and Humanities*, *29*(4), 2301–2313. https://doi.org/10.47836/pjssh.29.4.11

Strickland, T. K., & Maccini, P. (2013). The effects of the concrete-representational-abstract integration strategy on the ability of students with learning disabilities to multiply linear expressions within area problems. *Remedial and Special Education*, *34*(3), 142–153. https://doi.org/10.1177/0741932512441712

Umar, U., Hasratuddin, H., & Surya, E. (2022). Pengembangan LKPD Berbasis Model Think Aloud Pair Problem Solving untuk Meningkatkan Kemampuan Pemecahan Masalah Matematis Siswa SD Negeri 067248 Medan. *Jurnal Cendekia : Jurnal Pendidikan Matematika*, *6*(3), 3402–3416. https://doi.org/10.31004/cendekia.v6i3.1884

Widodo, S. A., & Wahyudin. (2018). Selection of learning media mathematics for junior school students. *TOJET: Turkish Online Journal of Educational Technology*, *17*(1), 154–160. https://eric.ed.gov/?id=EJ1165728

Xiao, Y., & Watson, M. (2019). Guidance on Conducting a Systematic Literature Review. *Journal of Planning Education and Research*, *39*(1), 93–112. https://doi.org/10.1177/0739456X17723971

Yeh, C. Y. C., Cheng, H. N. H., Chen, Z. H., Liao, C. C. Y., & Chan, T. W. (2019). Enhancing achievement and interest in mathematics learning through Math-Island. *Research and Practice in Technology Enhanced Learning*, *14*(5), 1–19. https://doi.org/10.1186/s41039-019-0100-9

Yuliyanto, A., & Turmudi. (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*(11), 5901–5912. https://doi.org/10.13189/ujer.2020.082224

Zhang, S., Yu, S., Xiao, J., Liu, Y., & Jiang, T. (2022). The effects of concrete-representational-abstract sequence instruction on fractions for chinese elementary students with mathematics learning disabilities. *International Journal of Science and Mathematics Education*, *20*(7), 1481–1498. https://doi.org/10.1007/s10763-021-10215-9