

The effect of implementing the DACAR online learning model on critical thinking skill as of early childhood

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Abstract This research investigates how the online implementation of the DACAR learning model comprising Demonstration, Association, Collaboration, Action, and Reward impacts the development of critical thinking abilities in early childhood. The study is grounded in the belief that fostering critical thinking from an early age is crucial, even when instruction occurs virtually. A quantitative approach was employed, utilizing a quasi-experimental design known as the One Group Pretest-Posttest Design. The participants consisted of 30 group B students from Insan Cendekia Kindergarten in Sidoarjo during the 2024/2025 academic year, selected through total sampling. Data were gathered through assessments and observations aligned with early childhood critical thinking indicators. Analysis was conducted using the SPSS software, including tests for normality, homogeneity, and paired sample t-tests. Findings revealed a statistically significant improvement between pretest and posttest scores, with a p-value of 0.000 ($p < 0.05$), indicating that the online DACAR model positively influences young children's critical thinking skills. These results suggest that DACAR is an effective method for enhancing cognitive development during early learning, even in an online format.

Keywords: online learning, DACAR model, critical thinking, early childhood

1. Introduction

The rapid progress of science and technology has led to significant transformations in education systems globally, reaching all levels including early childhood education (Basri, 2023; Irsyadillah et al., 2022; Wang et al., 2024). The widespread shift toward digital technology is reshaping how children acquire knowledge, communicate with others, and perceive the world around them (Bilyalova et al., 2020; livari et al., 2020). In the current digital age, learning is no longer restricted to traditional in-person classroom settings; instead, it has increasingly moved toward virtual formats that rely on technology like computers, tablets, and internet connectivity (Dakhi et al., 2020). This shift presents both difficulties and possibilities for the education sector, particularly in developing instructional methods that can deliver engaging and meaningful learning experiences through digital platforms.

This situation calls for innovative teaching strategies that not only keep pace with technological progress but also align with the developmental needs of young learners (Boiliu et al., 2024). Early childhood education goes beyond academics, encompassing the development of character, social-emotional skills, motor abilities, language, and cognitive growth (Rohmah et al., 2023). Critical thinking is one of the key cognitive skills that should be nurtured from an early age (Imamah & Muqowim, 2020). In early childhood, often referred to as the golden age, the brain undergoes rapid development, laying the groundwork for more advanced thinking abilities later in life (Lestari et al., 2020; Putra, 2022). As a result, educators play a crucial role in offering activities that encourage children to observe carefully, ask questions, think critically, and draw conclusions (Septiani et al., 2016).

Critical thinking involves the capacity to analyze information in a logical, objective, and reasoned manner, enabling sound decisions grounded in evidence or experience (Novandi et al., 2025; Robbani, 2025). Children possessing these abilities often demonstrate greater independence, approach information with healthy skepticism, and show improved problem-solving skills (Sari et al., 2021; Zulyusri et al., 2023). Nonetheless, implementing online learning presents notable difficulties when it comes to nurturing critical thinking abilities, particularly among young children (Rahayu et al., 2023; Sya'fi'i et al., 2021). Restricted interaction, decreased physical and social engagement, and a shortage of diverse exploratory activities can lead to children becoming more passive and missing chances to enhance their higher-order thinking skills (Novianto et al., 2024; Wati et al., 2024). Previous research has shown that the DACAR learning model, consisting of Demonstration, Association, Collaboration, Action, and Reward, has proven valid and reliable for developing critical and creative thinking skills in early childhood (Gusmaniarti et al., 2025). This approach integrates multiple activity-based learning techniques through a sequence



of stages: demonstration (observing real examples), association (linking new information to prior knowledge), collaboration (engaging with peers), action (practicing and applying skills), and reward (offering positive feedback). By positioning children as active participants rather than passive receivers, this model encourages greater motivation, emotional engagement, and the cultivation of reflective and analytical thinking.

However, the use of the DACAR Model within online learning environments, particularly for young children, remains largely unexplored through empirical research. Challenges such as adapting each DACAR stage to a virtual setting and the reduced opportunities for face-to-face interaction highlight the importance of further evaluating how effective this method is when implemented online. Moreover, research examining the influence of the DACAR model on the development of 21st-century skills in online learning environments remains scarce. Similarly, the integration of technology in implementing innovative learning models is still limited. This is largely due to challenges in adapting such models to remote learning settings, often caused by insufficient access to digital tools, as well as limited technological proficiency among both educators and students. Despite these obstacles, few studies have explored how the DACAR model might effectively address these specific issues. What sets the online use of the DACAR model apart is its structured sequence of learning phases, which aligns well with modular instruction. It also offers flexibility in adapting to various digital tools and platforms, supports learner autonomy and collaborative engagement in virtual settings, incorporates authentic and project-based assessments, and fosters meaningful learning interactions even in the absence of face-to-face contact. Several studies have indicated that digital learning platforms played a significant role in supporting early childhood education during the COVID-19 pandemic (Kim, 2020). For instance, online modalities provided alternative ways to maintain learning continuity when in-person classes were disrupted (Supriyatno, 2020). Additionally, the integration of e-learning has shown potential in fostering students' critical thinking, which is an essential skill in 21st-century education. The shift toward technology-enhanced learning is increasingly viewed as a necessary step to equip students with higher-order thinking abilities that are vital in modern educational contexts (Wardani, 2018).

This study seeks to examine the impact of applying the DACAR learning model in an online setting on the critical thinking abilities of young children. Given the growing demand for innovative teaching methods that align with the digital age while maximizing children's developmental growth, this research holds significant value. The findings are anticipated to offer theoretical insights for advancing early childhood education and serve as a practical guide for educators, parents, and policymakers in creating effective, engaging, and meaningful learning experiences in today's digital environment.

2. Materials and Methods

This research employed a quantitative method using a quasi-experimental One Group Pretest-Posttest design. Participants first completed a pretest, followed by an intervention involving online learning through the DACAR model, and finally took a posttest to evaluate the impact of the intervention (Djollong, 2014). The study population consisted of all Group B students at Insan Cendekia Kindergarten Sidoarjo for the 2024/2025 academic year, totaling 30 children. Due to the small and accessible population size, saturated sampling (total sampling) was employed, including every member of the group as participants in the research. This study involved two variables: the independent variable (X), which is the online DACAR learning model (Demonstration, Association, Collaboration, Action, Reward), and the dependent variable (Y), representing early childhood critical thinking skills. Data were collected using two primary methods: tests and observations. The tests consisted of activity-based tasks or questions aimed at evaluating critical thinking abilities before and after the intervention, while observations were conducted using assessment sheets aligned with early childhood critical thinking indicators, such as skills in observing, comparing, reasoning, and drawing conclusions. The research tools consisted of critical thinking skill test sheets and observation forms. In this study, the critical thinking instrument was evaluated by three experts comprising educators, academic lecturers, and evaluation specialists and the results indicated that the instrument is valid for assessing practical thinking skills. In the online implementation of the DACAR learning model comprising Demonstration, Association, Collaboration, Action, and Reward the operationalization and measurement of critical thinking skills are aligned with each stage of the learning process and tailored to relevant digital activities and assessment tools. During the Demonstration phase, learners are asked to watch instructional videos and respond to comprehension questions via platforms like Google Forms; their responses are evaluated based on interpretation and clarification skills, using a 1–4 accuracy based scoring scale. In the Association stage, students engage in activities such as interactive quizzes and submit brief reflections through platforms like Google Classroom to assess their ability to analyze and infer, with scores determined using an analytical rubric. The Collaboration phase emphasizes argument evaluation and discussion, where students interact in LMS forums or virtual breakout rooms to examine case studies; participation and reasoning quality are then rated using a rubric focused on engagement and critical depth. The Action stage involves applying learned ideas by creating digital outputs such as posters, infographics, or short videos which are assessed through a rubric that considers creativity, relevance, and analytical insight, again using a 1–4 scale. Lastly, in the Reward phase, students reflect on their learning through journals or short video logs, evaluated using a rubric that captures the depth, sincerity, and alignment of their reflections with the material. Across all stages, a consistent scoring rubric is applied to assess critical thinking, where a score of 1 indicates no demonstration of the targeted skills, score 2 reflects minimal and imprecise demonstration, score 3 denotes adequate and relevant use of critical thinking, and score 4 represents clear, logical, and consistently strong critical engagement with the learning content. Data from

the pretest and posttest were analyzed using descriptive and inferential statistics with SPSS software. This included calculating measures like mean, minimum, maximum, and standard deviation, along with conducting tests for normality (Kolmogorov-Smirnov), homogeneity (Levene's Test), and paired sample t-tests to identify significant differences between pretest and posttest results. The analysis was conducted using a significance level of $\alpha = 0.05$.

3. Results

This section presents the analysis results aimed at evaluating the impact of the online DACAR learning model on young children's critical thinking skills. The analysis focuses on comparing pretest and posttest data collected after students participated in the DACAR-based online learning intervention.

Descriptive statistics were used to summarize the data, including calculations of the mean, standard deviation, maximum, and minimum values for both pretest and posttest scores. A normality test was conducted to assess whether the data followed a normal distribution, which is a key assumption for parametric tests. The homogeneity test examined whether the variances between pretest and posttest results were consistent which is explained in table 1. Finally, the paired sample t-test was applied to determine if there was a statistically significant difference between the pretest and posttest scores, allowing conclusions about the effect of the online DACAR learning model on critical thinking skills in early childhood.

Table 1 Descriptive Statistics.

N	30	30
Mean (Rata-rata)	61.53	74.20
Std. Deviation	7.85	6.45
Minimum	50	60
Maximum	75	88

The average critical thinking score improved from 61.53 to 74.20 following the implementation of the DACAR model. This suggests that the online DACAR learning approach effectively enhances critical thinking abilities in young children. The score increase indicates that children became more proficient at observing, analyzing, and making conclusions after participating in learning activities structured around the stages of Demonstration, Association, Collaboration, Action, and Reward. Next, the normality results will be presented in Table 2.

Table 2 Normality Test (Kolmogorov-Smirnov Test).

Group	Sig. (Kolmogorov-Smirnov)
Pretest	0.200
Posttest	0.144

Because the significance value exceeds 0.05, it suggests that the data in both groups follow a normal distribution. This implies there is no notable deviation from what would be expected in a normal distribution. After normality, the homogeneity test is continued in Table 3.

Table 3 Homogeneity Test (Levene's Test).

Levene Statistic	df1	df2	Sig.
1.527	1	58	0.221

Since the significance value is 0.221, which is greater than 0.05, it indicates that the variance between the pretest and posttest data is homogeneous. This uniformity in data variation satisfies a key assumption required for parametric tests like the paired t-test. Having homogeneous data ensures that the statistical analysis results are more accurate and dependable when evaluating the in Table 4 impact of the DACAR learning model on children's critical thinking abilities.

Table 4 Paired Sample t-Test.

	Mean	Std. Dev.	t	df	Sig. (2-tailed)
Posttest - Pretest	12.67	4.83	14.15	29	0.000

Since the Sig. (2-tailed) value is less than 0.05, a significant difference exists between the pretest and posttest scores. This indicates that implementing the DACAR model in an online setting has a meaningful impact on students' critical thinking abilities. In other words, children's critical thinking skills improved considerably following their participation in learning activities using the online DACAR approach. These findings highlight the model's effectiveness in fostering critical thinking during early childhood development.

4. Discussion

Analysis using the Paired Sample t-Test revealed a significant improvement in students' critical thinking skills after the implementation of the DACAR learning model online. The average posttest score rose markedly to 74.20 from the pretest

average of 61.53, with a significance value of 0.000 ($p < 0.05$). These results demonstrate that the DACAR model effectively enhances critical thinking abilities in early childhood, even when delivered through an online learning format.

The DACAR model, composed of five key stages Demonstration, Association, Collaboration, Action, and Reward is created to foster an engaging and meaningful learning experience. Even in an online learning environment, this method effectively promotes active participation by utilizing interactive tools such as demonstration videos, virtual group discussions, collaborative tasks, and motivating incentives.

The findings indicate that the guided inquiry learning approach effectively enhances students' critical thinking abilities (Sonia et al., 2023). The project-based learning approach positively and significantly impacts children's creative thinking skills (Cahyaningsih & Harun, 2023). The Team-Based Learning model has a greater effect on enhancing students' critical thinking skills compared to the Problem-Based Learning model (Nursulistyo, 2021). Using the discovery learning approach to enhance critical thinking skills (Yuliati & Susianna, 2023).

The demonstration phase offers clear examples that assist children in grasping concepts both visually and within context (Cecep et al., 2022; Khanasta et al., 2016). Association enables children to connect new knowledge with their prior experiences, enhancing both comprehension and retention (Badjeber, 2017; Pertiwi et al., 2018). Additionally, collaboration helps children develop skills in communication, consider others' viewpoints, and work together with peers to solve problems (Sudarti & Diana, 2023; Ulhusna et al., 2020). The action phase motivates students to apply critical thinking in decision-making and task completion, while rewards offer positive feedback that boosts their motivation to learn (Anjani, 2018; Utomo, 2013).

These findings align with Piaget's theory of cognitive development, which identifies early childhood as the preoperational stage a period when children start to develop basic symbolic and logical thinking skills (Agung et al., 2019). By using a systematic and consistent method like the DACAR model, children can progressively build their critical thinking skills.

Moreover, these findings support earlier studies indicating that active, experience-based learning approaches significantly enhance critical thinking abilities (Ritonga & Napitupulu, 2024), even in an online learning environment (Yunita et al., 2021). The effectiveness of the DACAR model in an online setting demonstrates that advanced thinking skills can be effectively nurtured through appropriate methods, despite the reduced face-to-face interaction between teachers and students.

Therefore, it can be concluded that applying the DACAR learning model online aligns well with the demands of digital-era education and effectively enhances critical thinking skills in early childhood, which serve as a crucial basis for their academic and social growth in the future. This study presents several limitations that should be acknowledged. One key constraint lies in the high dependence on parental engagement and the availability of technological resources at home during the implementation of the DACAR model in online early childhood education. As a result, outcomes may differ based on the family's socio-economic background. Additionally, assessing critical thinking in young children remains a challenge due to the limited availability of measurement tools that align well with their developmental and cognitive stages. The study's scope was also restricted to a specific group of participants within a particular geographical area, making it necessary to approach the generalization of these findings with caution.

The encouraging results demonstrating the potential of the online DACAR model in fostering critical thinking among early learners suggest several pathways for further investigation. Future studies should consider involving participants from more diverse social and cultural contexts to examine the model's broader applicability. Moreover, there is a pressing need to design and validate assessment tools that accurately capture early childhood critical thinking skills within digital learning environments. Longitudinal research is recommended to explore the sustained effects of the DACAR approach on children's cognitive and metacognitive growth over time. It would also be beneficial to investigate how targeted support and training for teachers and parents can enhance their roles in facilitating DACAR-based online learning, ultimately improving the model's effectiveness in early childhood education.

5. Conclusions

The online DACAR learning model has been shown to significantly and positively impact the development of critical thinking skills in early childhood. Based on these findings, it is recommended that further studies be conducted involving samples from elementary school students.

Ethical considerations

Not applicable.

Conflict of Interest

The authors declare no conflicts of interest.

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References

- Agung, R., Prodi, J., Guru, P., & Ibtidaiyah, M. (2019). Analisis Teori Perkembangan Kognitif Piaget Pada Tahap Anak Usia Operasional Konkret 7-12 Tahun Dalam Pembelajaran Matematika. *Al-Adzka: Jurnal Ilmiah Pendidikan Guru Madrasah Ibtidaiyah*, 9(1), 27–34.
- Anjani, S. R. (2018). Penerapan Model Pembelajaran Nilai (Value Learning) Melalui Pendekatan Pembelajaran Berbuat (Action Learning Approach). *Jurnal Koulutus: Jurnal Pendidikan Kahuripan*, 1(1), 11–34.
- Badjeber, R. (2017). Asosiasi Kemampuan Penalaran Matematis Dengan Kemampuan Koneksi Matematis Siswa Smp Dalam Pembelajaran Inkuiri Model Alberta. *JPPM*, 10(2), 50–56. <http://dx.doi.org/10.30870/jppm.v10i2.2030>
- Basri, H. (2023). Dampak Globalisasi Terhadap Sistem Pendidikan: Perspektif Sosiologi Pendidikan. *Al-Murabbi Jurnal Pendidikan Islam*, 1(1), 128–143. <https://doi.org/10.62086/al-murabbi.v1i1.446>
- Bilyalova, A. A., Salimova, D. A., & Zelenina, T. I. (2020). Digital Transformation in Education. In *Lecture Notes in Networks and Systems* (Vol. 78, pp. 265–276). Springer. https://doi.org/10.1007/978-3-030-22493-6_24
- Boiliu, E. R., Johanis, J., & Messakh. (2024). Pembelajaran Adaptif sebagai Inovasi Strategi Pembelajaran bagi Anak Usia Dini. *Real Kiddos: Jurnal Pendidikan Anak Usia Dini*, 2(2), 133–153. <https://doi.org/10.53547/realkiddos.v>
- Cahyaningsih, S., & Harun, H. (2023). Pengaruh Metode Pembelajaran Proyek terhadap Kemampuan Berpikir Kritis dan Kreativitas Anak. *Jurnal Obsesi : Jurnal Pendidikan Anak Usia Dini*, 7(5), 5481–5494. <https://doi.org/10.31004/obsesi.v7i5.5034>
- Cecep, Thosin Waskita, D., & Sabilah, N. (2022). Upaya Meningkatkan Konsentrasi Belajar Anak Usia Dini Melalui Metode Demonstrasi. *Jurnal Tahsinia*, 3(1), 63–70. <https://doi.org/10.57171/jt.v3i1.313>
- Dakhi, O., Jama, J., & Irfan, D. (2020). Blended Learning: A 21st Century Learning Model at College. *INTERNATIONAL JOURNAL OF MULTI SCIENCE*, 1(7), 50–55.
- Djollong, A. F. (2014). Tehnik Pelaksanaan Penelitian Kuantitatif. *ISTIQRRA'*, 11(1), 86–100.
- Dwi Nursulistyo, E. (2021). Model Team-Based Learning dan Model Problem-Based Learning Secara Daring Berpengaruh terhadap Kemampuan Berpikir Kritis Siswa. *Jurnal Mimbar Ilmu*, 26(1), 128–137. <https://doi.org/10.23887/mi.v26i1.32321>
- Gusmaniarti, Mustaji, Widodo, W., Suryanti, & Wiryanto. (2025). Development of DACAR as a new learning model to train critical and creative thinking skills: A study on early childhood education. *Edelweiss Applied Science and Technology*, 9(6), 742–750. <https://doi.org/10.55214/25768484.v9i6.7872>
- Ilivari, N., Sharma, S., & Ventä-Olkkonen, L. (2020). Digital transformation of everyday life – How COVID-19 pandemic transformed the basic education of the young generation and why information management research should care? *International Journal of Information Management*, 55. <https://doi.org/10.1016/j.ijinfomgt.2020.102183>
- Imamah, Z., & Muqowim. (2020). Pengembangan kreativitas dan berpikir kritis pada anak usia dini melalui metode pembelajaran berbasis STEAM and loose part. *YINYANG Journal Studi Islam, Gender, Dan Anak*, 15(2), 263–277. <https://doi.org/10.24090/yinyang.v15i2.3917>
- Khanasta, I., Sinon, I. L. S., & Widyaningsih, S. W. (2016). Penerapan Model Pembelajaran Berbasis Fenomena Menggunakan Metode Demonstrasi Terhadap Berpikir Kritis Peserta Didik Kelas XI IPA SMA Yapis Manokwari. *Wahana Didaktika*, 14(3), 14–27. <https://doi.org/10.31851/wahanadidaktika.v14i3.1081>
- Lestari, R. H., Mudhawaroh, M., & Ratnawati, M. (2020). Intelligence Optimization in the Golden Age by Stimulating the Right-Brain in Mojokrapak Village, Tembelang District, Jombang Regency. *NUCLEUS*, 1(2), 58–61. <https://doi.org/10.37010/nuc.v1i2.166>
- Megiana Pertiwi, C., Jayanti, R. A., Afrilianto, M., Siliwangi, I., Terusan, J., Sudirman, J., ... Com, C. M. (2018). Asosiasi Antara Kemampuan Generalisasi Matematik Dengan Self-Concept Siswa Smp Yang Menggunakan Strategi Pembelajaran Berbasis VBA Microsoft Excel. *Jurnal Pembelajaran Matematika Inovatif*, 1(3). <https://doi.org/10.22460/jpmi.v1i3.371-382>
- Novandi, M., Serani, G., Djudin, T., & Suratman, D. (2025). Keterampilan Berpikir Kritis dan Pengajarannya Di Sekolah Dasar. *JURNAL PENDIDIKAN DASAR PERKHASA: Jurnal Penelitian Pendidikan Dasar*, 11(1), 649–669. <https://doi.org/10.31932/jpdp.v11i1.4509>
- Novianto, A., Laela Fitriani, N., Saka Deniswa, A., Hermalia Nur Izzati, M., Firdaus, F., Yudha Ningrum, N., & Citra Dewi, R. (2024). Kalam Cendekia: Jurnal Ilmiah Kependidikan Analisis Kesulitan Belajar Matematika dalam Penerapan Kurikulum Merdeka di Sekolah Dasar. *Kalam Cendekia: Jurnal Ilmiah Kependidikan*, 12(2), 946. <https://doi.org/10.20961/jkc.v12i2.88914>
- Putra, W. (2022). Cognitive Development in the Golden Ages. *Journal of Educational Analytics*, 1(3), 215–224. <https://doi.org/10.55927/jeda.v1i3.1695>
- Rahayu, E. Y., Nurani, Y., & Meilanie, S. M. (2023). Pembelajaran yang terinspirasi STEAM: Menumbuhkan Keterampilan Berpikir Kritis melalui Video Tutorial. *Jurnal Obsesi : Jurnal Pendidikan Anak Usia Dini*, 7(3), 2627–2640. <https://doi.org/10.31004/obsesi.v7i3.4228>
- Ritonga, D., & Napitupulu, S. (2024). Implementasi Metode Pembelajaran Aktif dalam Meningkatkan Keterampilan Berpikir Kritis Siswa Sekolah Dasar. *Education & Learning*, 4(1), 38–45. <https://doi.org/10.57251/el.v4i1.1292>
- Robbani, H. (2025). Pengembangan Keterampilan Berpikir Kritis Melalui Pembelajaran Berbasis Masalah. *ABDUSSALAM: Jurnal Pendidikan Dan Kebudayaan Islam*, 01(01), 79–85.
- Rohmah, R. R., Yusuf, A., Azizah, R., & M., R. N. (2023). Peran Pendidikan Holistik Bagi Pengembangan Karakter Anak Usia Dini. *Jurnal Dimensi Pendidikan Dan Pembelajaran*, 11(1), 154–165. <https://doi.org/10.24269/dpp.v11i1.8268>
- Sajida Irsyadillah, N., Imeldha Putri, R., Rindri Brilian Amori, M., Wati, S., Aliya Afrianti, S., Haidlor, M., & Afandi, A. (2022). Efek Penggunaan Teknologi Informasi Dalam Pembelajaran Anak Usia Dini. *Journal Of Early Childhood Education And Research*, 3. <https://doi.org/10.19184/jecer.v3i1.28558>
- Sari, R. M., Sumarmi, Astina, I. K., Utomo, D. H., & Ridhwan. (2021). Increasing Students Critical Thinking Skills and Learning Motivation Using Inquiry Mind Map. *International Journal of Emerging Technologies in Learning*, 16(3), 4–19. <https://doi.org/10.3991/ijet.v16i03.16515>
- Septiani, R., Widyaningsih, S., Khabib, M., & Igomh, B. (2016). Tingkat Perkembangan Anak Pra Sekolah Usia 3-5 Tahun Yang Mengikuti dan Tidak Mengikuti Pendidikan Anak Usia Dini (PAUD). *Jurnal Keperawatan*, 4(2), 114–125. <https://doi.org/10.26714/jkj.4.2.2016.114-125>
- Sonia, T., Alberida, H., Arsih, F., & Selaras, G. H. (2023). Pengaruh Model Pembelajaran Inkuiri Terbimbing Terhadap Keterampilan Berpikir Kritis Peserta Didik Pada Pembelajaran Biologi. *Bioilmi: Jurnal Pendidikan*, 19(1), 78–86. Retrieved from <http://jurnal.radenfatah.ac.id/index.php/bioilmi>
- Sudarti, & Diana. (2023). Penerapan STEAM Untuk Mengembangkan Kemampuan Kolaborasi Anak Usia Dini. *Jurnal Usia Dini*, 9(2), 293–01.
- Syafi'i, I., Chusnah, A., Inayati, N. A., & Sari, L. P. (2021). Strategi Pendidikan dalam Menumbuhkan Kemampuan Berpikir Kritis Anak Usia Dini di Masa Covid-19. *JECED : Journal of Early Childhood Education and Development*, 3(1), 33–40. <https://doi.org/10.15642/jeced.v3i1.816>

- Ulhusna, M., Putri, S. D., & Zakirman. (2020). Permainan Ludo untuk Meningkatkan Keterampilan Kolaborasi Siswa dalam Pembelajaran Matematika. *International Journal of Elementary Education*, 4(2), 130–137. <https://doi.org/10.23887/ijee.v4i2.23050>
- Utomo, U. (2013). Analisis Kebutuhan Guru Seni Musik Dalam Konteks Pelaksanaan Pembelajaran Berbasis Action Learning di Sekolah. *Harmonia: Journal of Arts Research and Education*, 13(2), 110–119. <https://doi.org/10.15294/harmonia.v13i2.2777>
- Wang, C., Chen, X., Yu, T., Liu, Y., & Jing, Y. (2024, December 1). Education reform and change driven by digital technology: a bibliometric study from a global perspective. *Humanities and Social Sciences Communications*, Vol. 11. Springer Nature. <https://doi.org/10.1057/s41599-024-02717-y>
- Wati, P., Nusantara, T., & Utama, C. (2024). Efektivitas PjBL-STEM Terhadap Keterampilan Berpikir Kritis dan Motivasi Belajar Siswa Sekolah Dasar. *Jayapangus Press Cetta: Jurnal Ilmu Pendidikan*, 7(2). Retrieved from <https://jayapanguspress.penerbit.org/index.php/cetta>
- Yuliati, C. L., & Susianna, N. (2023). Penerapan Model Pembelajaran Discovery Learning Dalam Meningkatkan Keterampilan Proses Sains, Berpikir Kritis, dan Percaya Diri Siswa. *Scholaria: Jurnal Pendidikan Dan Kebudayaan*, 13(1), 48–58. <https://doi.org/10.24246/j.js.2023.v13.i1.p48-58>
- Yunita, A. S., Suryanti, & SUpardi, Z. A. I. (2021). Implementasi Model Pembelajaran Berbasis Blended Learning Untuk Meningkatkan Kemampuan Keterampilan Berpikir Kritis dan Hasil Belajar Siswa SD. *Cetta: Jurnal Ilmu Pendidikan*, 4(3), 594–606. Retrieved from <http://jayapanguspress.penerbit.org/index.php/cetta>
- Zulyusri, Z., Elfira, I., Lufri, L., & Santosa, T. A. (2023). Literature Study: Utilization of the PjBL Model in Science Education to Improve Creativity and Critical Thinking Skills. *Jurnal Penelitian Pendidikan IPA*, 9(1), 133–143. <https://doi.org/10.29303/jppipa.v9i1.2555>