



The Application of Augmented Reality Media to Improve Cognitive Abilities in Early Childhood

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Abstract: The purpose of this study was to determine the effect of applying Augmented Reality media in improving the cognitive abilities of early childhood students at Aisyiyah Bustanul Athfal 1 Kendari Kindergarten. This study employs a quantitative research approach using a pretest-posttest experimental design. The instrument used in this study is an observation assessment sheet using a Likert scale. This study employs total population sampling, so all 16 children in Class B of Aisyiyah Bustanul Athfal 1 Kendari Kindergarten were included as the sample. The data analysis techniques used in this study include: (1) calculating the average change in scores, and (2) the cognitive development index of children. Based on the results of the cognitive development calculation, a percentage of 81.25% was obtained. This indicates a significant improvement in children's cognitive abilities following the use of Augmented Reality (AR) media. The children demonstrated better ability in recognizing objects, such as fruits, vegetables, animals, and vehicles, as well as in following instructions given through the AR medium. Moving forward, more schools should consider integrating AR technology into their teaching and learning processes. Additionally, it is crucial to continually enhance the infrastructure and accessibility of AR devices, ensuring that all children can benefit from them.

Abstrak: Tujuan penelitian ini adalah untuk menentukan pengaruh penerapan media Augmented Reality dalam meningkatkan kemampuan kognitif anak-anak usia dini di Taman Kanak-Kanak Aisyiyah Bustanul Athfal 1 Kendari. Penelitian ini merupakan penelitian kuantitatif dengan desain eksperimen pretest-posttest. Instrumen yang digunakan dalam penelitian ini adalah lembar penilaian observasi menggunakan skala Likert. Penelitian ini menggunakan sampling populasi total, sehingga semua 16 anak di Kelas B Taman Kanak-Kanak Aisyiyah Bustanul Athfal 1 Kendari termasuk sebagai sampel. Teknik analisis data yang digunakan dalam penelitian ini meliputi: (1) menghitung rata-rata perubahan skor, dan (2) indeks perkembangan kognitif anak-anak. Berdasarkan hasil perhitungan perkembangan kognitif, diperoleh persentase sebesar 81,25%. Hal ini menunjukkan adanya peningkatan yang signifikan dalam kemampuan kognitif anak-anak setelah menggunakan media Augmented Reality (AR). Anak-anak menunjukkan kemampuan yang lebih baik dalam mengenali objek, seperti buah-buahan, sayuran, hewan, dan kendaraan, serta dalam mengikuti instruksi yang diberikan melalui media AR. Ke depan, lebih banyak sekolah harus mempertimbangkan untuk mengintegrasikan teknologi AR ke dalam proses belajar mengajar mereka. Selain itu, penting untuk terus meningkatkan infrastruktur dan aksesibilitas perangkat AR agar semua anak dapat memanfaatkannya.

A. Introduction

The current development of education is clearly marked by the integration of technological advances that educators utilise as learning media (Adhe et al., 2023; Wijayanti et al., 2023). Especially in early childhood education, the use of interactive and engaging media plays a crucial role in stimulating various aspects of children's development, particularly cognitive development (Maulidina et al., 2020; Saputra et al., 2024). At this stage, children learn best through enjoyable, concrete, and visual experiences such as educational games and multimedia activities. This aligns with Piaget's theory of cognitive development, which emphasizes the importance of active exploration and interaction with the environment in building knowledge structures (Ondog & Kilag, 2023). Similarly, Vygotsky's socio-cultural theory highlights the role of mediated learning tools, such as Augmented Reality (AR), in scaffolding children's cognitive processes (Yildiz, 2025).

In Indonesia, Early Childhood Education (PAUD) aims to facilitate the optimal development of children's potential through age-appropriate learning experiences (Puspitasari et al., 2022). However, the implementation of digital-based learning media remains limited in many PAUD institutions. A preliminary survey and teacher interviews conducted at Aisyiyah Bustanul Athfal 1 Kendari Kindergarten revealed that 87.5% of learning activities still rely on conventional tools such as picture books, two-dimensional aids, and storytelling. None of the teachers has used Augmented Reality (AR) applications as part of classroom instruction. This indicates a significant gap between the availability of technology and its actual integration into early learning practices (Humaida & Abidin, 2021).

Augmented Reality offers unique affordances compared to other digital media, such as videos or static animations. By blending virtual 3D elements into the real-world environment, AR provides an immersive and interactive learning experience that enhances attention, memory retention, and conceptual understanding (Nasution et al., 2022). In the Indonesian educational context, AR has the potential to overcome limitations of traditional teaching materials by visualizing abstract concepts in a way that is culturally relevant and readily comprehensible to young learners.

Previous studies have consistently reported the positive impact of AR-based learning media on children's cognitive and creative skills. Fauziah et al (2022) found that AR increased children's creativity, emotional engagement, and collaboration. Nasution et al (2022) demonstrated that AR encouraged teachers' digital literacy while fostering an enjoyable learning environment. Sundari & Margaretha (2023) revealed that AR can translate abstract material into concrete and moral-learning contexts. Hartanti & Kurniawan (2022) further reported that AR-based 3D animation significantly enhanced children's logical thinking and imagination. Nevertheless, most of these studies lacked contextual adaptation to local curricula and did not directly measure the cognitive development outcomes within specific ECE institutions.

Unlike previous works, this study developed and implemented an AR medium tailored explicitly to the early childhood education curriculum at Aisyiyah Bustanul Athfal 1 Kendari. The AR application transforms two-dimensional images into interactive 3D

objects accessible via smartphones, thereby providing concrete, enjoyable, and developmentally appropriate learning experiences (Rashevskaya et al., 2020; Arifin et al., 2023).

The design also considers local cultural elements and the urban learning context, ensuring that the media is both relevant and accessible. Theoretically, this study extends the application of Piaget's and Vygotsky's theories to AR-based learning, while providing a practical implementation model that can serve as a reference for teachers in similar settings. Therefore, this study aims to determine the effect of applying Augmented Reality media on improving the cognitive abilities of early childhood students at Aisyiyah Bustanul Athfal 1 Kendari Kindergarten.

B. Method

This study employed a quantitative approach using a quasi-experimental design with a pretest-posttest one-group model. The purpose of this design is to determine the causal relationship between the use of Augmented Reality (AR) media (independent variable) and the improvement of children's cognitive abilities (dependent variable).

The quasi-experimental design was chosen because the study was conducted in a natural classroom setting, where random assignment was not feasible. The experimental design can be represented as follows:

$$O_1 - X - O_2$$

Where O_1 represents the pre-test (children's cognitive ability before AR intervention), X represents the treatment (use of AR media), and O_2 represents the post-test (children's cognitive ability after AR intervention).

The population in this study consisted of all students in Class B of Aisyiyah Bustanul Athfal 1 Kendari Kindergarten, totaling 16 children. Total population sampling was applied because the class size was relatively small, allowing all participants to be included. Participants were aged between 5 and 6 years, comprising seven boys and nine girls. Most participants came from middle- to lower-socioeconomic backgrounds, as indicated by their parents' occupational data. Inclusion criteria included: (1) regular attendance in class, (2) no cognitive or sensory impairments reported by parents or teachers, and (3) ability to follow basic classroom instructions. Exclusion criteria included children with diagnosed learning difficulties or inconsistent attendance during the intervention period.

The data processed are the data from the observation sheets used to assess children's cognitive development, presented in Table 1.

Table 1. Assessment Observation Sheet

No.	Assessment Observation Statement
1.	Children can mention at least three names of fruits that have been displayed in AR media.
2.	Children can correctly classify between fruits and vegetables.

No.	Assessment Observation Statement
3.	Children can match animal names with pictures that appear in AR media.
4.	Children can differentiate between land, sea, and air vehicles based on the transport pictures displayed.
5.	The child can correctly name the colours of fruits and vegetables that appear in AR.
6.	The child can imitate the sound of the animal that appears in AR.
7.	Children can answer questions about the functions of various vehicles displayed in AR media.
8.	The child can follow instructions in AR to choose fruits or vegetables based on specific shapes.
9.	Children can maintain focus for at least 5 minutes while using AR media without being easily distracted.
10.	The child shows interest and enthusiasm in using AR media for learning.

The validity of the instrument was established through expert judgment by three early childhood education specialists who reviewed the relevance, clarity, and comprehensiveness of each item. Construct validity was confirmed with a CVI (Content Validity Index) score of 0.92, indicating excellent content validity. Internal consistency reliability was assessed using Cronbach's Alpha ($\alpha = 0.88$), demonstrating high reliability.

The assessment items covered aspects such as memory recall, classification ability, object matching, recognition of colors and shapes, and problem-solving skills. Each item was scored using a 4-point Likert scale with the following criteria: (1) Not yet developed, (2) Developing as expected, (3) Developed as expected, and (4) Well-developed. The observation was conducted by two trained observers – one researcher and one classroom teacher – to minimize observer bias. Inter-rater reliability was calculated using Cohen's kappa ($\kappa = 0.86$), indicating strong agreement between raters.

The research was carried out in three main stages: preparation, implementation, and evaluation. During the preparation phase, AR media was introduced to teachers, and children were familiarized with the use of the devices. During the implementation phase, children participated in AR learning sessions for two weeks, twice a week, each lasting 30 minutes. The post-test was conducted immediately after the final session. A visual summary of the research flow is presented below:



Figure 1. Research Flow Diagram

The data analysis techniques used in this study included: (1) calculation of average score changes, and (2) children's cognitive development index. Average score changes were used to measure the extent of changes in children's cognitive abilities before and after using AR media. The formula for average score changes is:

$$\text{Average Score Change} = \frac{\sum (\text{Post-test score} - \text{pre-test score})}{n}$$

The cognitive development index is used to assess the extent to which children's cognitive abilities have developed after being exposed to AR media. The formula for the children's Cognitive Development Index is:

$$\text{Index of Cognitive Development} = \frac{\text{Average Score Change}}{\text{Likert Scale Maximum Score}} \times 100\%$$

C. Result

This section presents the results of the study, which aimed to examine whether the use of Augmented Reality (AR) media could improve the cognitive abilities of early childhood students at Aisyiyah Bustanul Athfal 1 Kendari Kindergarten. Specifically, the analysis was designed to verify the research hypothesis that AR-based learning activities would lead to measurable progress in children's cognitive development compared to their initial performance. To test this hypothesis, two quantitative indicators were employed: (1) the change in average cognitive test scores (pre-test to post-test) and (2) the Cognitive Development Index, representing the proportion of children who reached the expected developmental level. These indicators serve as evidence to determine whether the observed improvements reflect meaningful learning outcomes attributable to the AR intervention. The following subsections describe the data, computations, and interpretations that demonstrate how the numerical results support the study's objectives and hypothesis.

The assessment of children's cognitive development was conducted by researchers through pre- and post-tests using the instruments listed in Table 1, which included indicators of early childhood cognitive development, such as memory, distinguishing between shapes and colors, grouping objects, and solving simple problems. Each indicator was assessed using a 4-point Likert scale. The assessment was conducted observationally by researchers during learning activities. The results of the data analysis are presented in Table 2:

Table 2. Research Data Analysis Results

No.	Student	Pre-test	Post-test	Delta (Δ)
1.	S1	30	35	5
2.	S2	30	36	6
3.	S3	35	38	3
4.	S4	28	30	2
5.	S5	34	37	3
6.	S6	31	36	5
7.	S7	29	34	5
8.	S8	31	34	3
9.	S9	34	34	0
10.	S10	30	35	5
11.	S11	38	40	2

No.	Student	Pre-test	Post-test	Delta (Δ)
12.	S12	27	29	2
13.	S13	28	30	2
14.	S14	33	39	6
15.	S15	34	35	1
16.	S16	37	39	2
Jumlah		509	561	52

Based on the data in Table 2, the average score change can be calculated using the following formula:

$$\text{Average Score Change} = \frac{\sum (\text{Post-test score} - \text{pre-test score})}{n}$$

$$\text{Average Score Change} = \frac{\sum (561 - 509)}{16} = 3,25.$$

Based on the data presented in Table 2, the total pre-test score for the 16 participating children was 509, and the post-test total increased to 561, yielding a cumulative gain of 52 points. This difference represents a mean increase of 3.25 points per child, which constitutes the first analytical indicator, the average score change. The pattern of improvement was consistent across almost all participants, with 15 children showing positive gains and only one child (S9) maintaining the same score. Such consistency suggests that the AR learning intervention generally showed improvement in children's cognitive performance, although it did not statistically prove an effect, as no inferential statistical testing was conducted.

The gradual and near-universal rise in scores provides empirical support for the study's hypothesis that AR media can enhance children's cognitive engagement and comprehension. In the context of early childhood development, even modest score increases signify meaningful learning progress, as they often reflect enhanced memory recall, improved attention to visual cues, and a better ability to classify and interpret objects, all of which are central components of cognitive growth. Thus, the quantitative data from Table 2 not only demonstrate measurable improvement but also lend practical support to the assumption that immersive and interactive AR experiences foster deeper cognitive stimulation in young learners.

Following the calculation of the average score change, the second analytical indicator, the Cognitive Development Index, was computed to provide a broader representation of children's progress across all measured domains using the following formula:

$$\text{Index of Cognitive Development} = \frac{\text{Average Score Change}}{\text{Likert Scale Maximum Score}} \times 100\%$$

$$\text{Index of Cognitive Development} = \frac{3,25}{4} \times 100\% = 81,25\%$$

Using the same pre- and post-test data, the index value was found to be 81.25%, assuming a maximum attainable score of 100 points. This percentage reflects the overall

proportion of developmental achievement relative to the ideal cognitive benchmark, confirming that most children reached the "independent" category in the observed cognitive dimensions.

This index value reinforces the earlier findings by showing that improvements were not limited to raw scores but extended across multiple cognitive domains, including memory, shape and colour recognition, object classification, and problem-solving skills. Among these, the most notable progress was observed in children's ability to recognize and differentiate visual objects and follow multi-step instructions, skills that were particularly strengthened by the interactive and immersive nature of AR media. Although the study did not include statistical significance testing or compute measures of variation such as standard deviation, the relatively uniform pattern of improvement across almost all participants suggests a stable positive trend rather than isolated individual gains.

Taken together, these findings indicate that AR media showed improvement in both targeted indicators – average score change and cognitive development index – thereby aligning closely with the research hypothesis that immersive digital media can meaningfully enhance cognitive engagement and development in early childhood learning contexts.

In summary, the results obtained from both analytical indicators consistently demonstrate that the use of Augmented Reality (AR) media showed improvement in the cognitive development of early childhood learners. The mean increase of 3.25 points and the Cognitive Development Index of 81.25% jointly indicate that the majority of children experienced measurable and meaningful progress in core areas such as memory, visual recognition, and problem-solving. These findings directly support the research objective, confirming that AR-based learning activities effectively stimulate children's thinking processes and enhance their engagement during cognitive tasks. The overall trend of improvement across nearly all participants also suggests that AR learning media can serve as a practical and developmentally appropriate tool for early education settings.

D. Discussion

This study aims to investigate the impact of Augmented Reality (AR) media on enhancing the cognitive abilities of early childhood students at Aisyiyah Bustanul Athfal 1 Kendari Kindergarten. Based on the data analysis results, there was a significant improvement in the children's cognitive abilities after using AR media. The changes in pre-test and post-test scores showed evident progress, with an average score change of 3.25. This is reflected in the calculation of the Cognitive Development Index, which reached 81.25%. This figure indicates that more than 70% of children experienced positive cognitive development after using AR media.

The improvement in children's cognitive abilities is clearly evident in their ability to recognise and name the fruits displayed in the AR media, correctly group fruits and vegetables, and match animal names with the corresponding images. This activity not only involves visual recognition but also strengthens children's memory and ability to identify objects, which is an important part of cognitive development in early childhood (Ritonga et

al., 2022). This AR media, which combines visual and auditory elements, allows children to learn more enjoyably and interactively, thereby enhancing their understanding of the concepts being taught (Lupita et al., 2024; Saputra et al., 2020).

In addition, children also demonstrated good ability in following instructions given through AR media, such as choosing fruits or vegetables based on specific shapes. The use of this media also helped maintain children's focus during the learning process. Children were able to focus for at least five minutes when using AR media, without being easily distracted. This is a positive indication, as good focus is a crucial indicator in children's cognitive development, particularly in processing the information provided.

According to Maharani et al (2022) and Yulisar et al (2020), Fun and interactive learning media can increase children's motivation to learn. Children's enthusiasm for interacting with AR media is also very high. They appear happy and excited in every learning session using this technology. This indicates that AR media not only captures children's attention but also sparks their interest and motivation to learn further. With fun features, such as interactive images and accompanying sounds, children feel more engaged in learning and actively participate in the activities (Saputra et al., 2025).

However, the implementation of AR media also faces several challenges. One of the biggest challenges is the limited availability of AR devices in schools. Not all children have equal access to these devices, which can limit their full opportunity to experience the benefits of this technology. Procuring adequate AR devices also requires significant costs, which can be a barrier for schools with limited budgets. Additionally, while the use of AR has proven effective, the time required to integrate AR media into existing learning activities presents its own challenges. Teachers must be able to balance the use of traditional methods with this new technology so that both approaches can complement and support children's development optimally.

In this case, teachers' readiness to adapt to new technologies also plays a vital role in optimising learning (Wulandari & Ambara, 2021). Teachers who are well-trained in using AR media can maximise the potential of this technology and ensure that children derive as much benefit as possible from learning. Therefore, teacher training is crucial so that they can utilize AR media effectively in the classroom.

From a socio-cultural perspective, this result highlights how urban early childhood education institutions, such as Aisyiyah Bustanul Athfal 1 Kendari, benefit from the integration of technology. Children who are familiar with smartphones and digital environments tend to adapt quickly to AR-based learning, which effectively bridges the gap between entertainment technology and educational purposes. Conversely, in rural settings where digital exposure is lower, adaptation may require a more extended adjustment period and teacher mediation.

The study also confirms Vygotsky's concept of the Zone of Proximal Development (ZPD), where AR acts as a scaffolding tool that enhances children's ability to perform tasks slightly beyond their current competence when guided by teachers. Moreover, according to

Dual Coding Theory, AR's combination of visual and auditory stimuli optimizes information encoding and retrieval, leading to improved memory consolidation.

Practically, these findings suggest that educators should consider adopting AR not only as a supplementary tool, but also as a central medium for introducing and reinforcing concepts in early learning contexts. However, successful implementation requires adequate infrastructure, teacher training, and contextual adaptation to different socio-economic environments. In conclusion, the discussion underscores that Augmented Reality media significantly supports the development of children's higher-order cognitive processes—such as analysis, classification, and reasoning—while also enhancing motivation and engagement through interactive learning experiences.

E. Implication

The findings of this study provide both theoretical and practical implications for the field of early childhood education. Theoretically, the study reinforces the growing body of evidence that Augmented Reality (AR) media can be an effective tool to support children's cognitive development by transforming abstract concepts into more concrete and engaging learning experiences. This supports the notion that technology-enhanced learning environments have a positive impact on cognitive stimulation in early childhood, particularly in enhancing memory, classification, and problem-solving abilities. The study highlights that AR-based learning can serve as an innovative instructional strategy for teachers, offering more interactive and enjoyable classroom activities that align with the developmental needs of young learners. The integration of AR into early childhood education also emphasizes the importance of teacher readiness and infrastructure support, ensuring that the potential of this technology is fully maximized in the learning process.

F. Limitation and Suggestion for Further Research

Despite the positive results, this study has several limitations. First, the research was conducted with a relatively small sample size (16 children), which limits the generalizability of the findings to broader populations. Second, the study was limited to one institution in an urban context and thus did not represent diverse educational settings, such as rural or under-resourced schools. Third, the absence of a control group makes it difficult to fully isolate the effect of AR media from other possible influencing factors. Finally, the study only examined cognitive development and did not explore other important developmental domains such as language, social-emotional, or motor skills.

Research should address these limitations by involving larger and more diverse samples across different regions and educational contexts to enhance the generalizability of the findings. Employing an experimental design with a control group is also recommended to obtain more robust evidence of the causal impact of AR media on early childhood development. In addition, future studies may extend the scope of AR applications to other developmental areas such as literacy, numeracy, creativity, and socio-emotional growth. Longitudinal studies would also be valuable in assessing the long-term effectiveness of AR

media in sustaining cognitive and developmental progress. Finally, it is suggested that future research explore the cost-effectiveness, accessibility, and teacher training aspects of AR implementation to ensure its sustainable integration into early childhood education.

G. Conclusion

This study aimed to determine the effect of applying Augmented Reality (AR) media on improving the cognitive abilities of early childhood students at Aisyiyah Bustanul Athfal 1 Kendari Kindergarten. The findings demonstrate that AR media has a significant positive effect on children's cognitive development, as reflected in an average score increase of 3.25 points and a cognitive development index of 81.25%. These results indicate that AR media effectively stimulate memory, recognition, classification, and problem-solving abilities in young children. Additionally, the interactive and enjoyable features of AR enhance children's focus, enthusiasm, and active participation in the learning process. Beyond supporting the achievement of cognitive indicators, the integration of AR provides evidence of the potential of technology-based media to transform early childhood education into a more engaging and developmentally appropriate environment. The essence of these findings suggests that AR is not only a supplementary learning tool but also a strategic innovation capable of bridging conventional methods with modern, interactive pedagogy.
















References

- Adhe, K. R., Suryanti, S., Wiryanto, W., Sukartiningsih, W., & Hendratno, H. (2023). Perkembangan Literasi dengan Pembelajaran Sentra Khusus TK B. *Jurnal Obsesi : Jurnal Pendidikan Anak Usia Dini*, 7(2), 2528–2537. <https://doi.org/10.31004/obsesi.v7i2.4273>
- Arifin, I. N., Abduh, I. B., & Juniarti, Y. (2023). Pengaruh Media Realia terhadap Kemampuan Menggambar pada Anak Usia Dini Kelompok B. *Jurnal Obsesi : Jurnal Pendidikan Anak Usia Dini*, 7(5), 6472–6482. <https://doi.org/10.31004/obsesi.v7i5.5265>
- Fauziah, N., Nafiah, N., Hartatik, S., & Sunanto, S. (2022). Penerapan Media Augmented Reality Pada Materi Ilmu Pengetahuan Alam Siswa Sekolah Dasar. *Jurnal Sekolah Dasar*, 7(2), 103-117. <https://doi.org/10.36805/jurnalsekolahdasar.v7i2.2116>
- Hartanti, D., & Kurniawan, M. (2022). Buku Literasi Augmented Reality sebagai Media Pendukung Pembelajaran Aspek Keaksaraan AUD. *Jurnal Obsesi : Jurnal Pendidikan Anak Usia Dini*, 6(4), 3100–3110. <https://doi.org/10.31004/obsesi.v6i4.2042>
- Humaida, R. T., & Abidin, M. Z. (2021). Penggunaan Media Busy Book Terhadap Kognitif Pengenalan Kemampuan Berhitung pada Anak Usia Dini. *ThufuLA: Jurnal Inovasi Pendidikan Guru Raudhatul Athfal*, 9(1), 135. <https://doi.org/10.21043/thufula.v9i1.10293>
- Lupita, M. Della, Iriyanto, T., & Anisa, N. (2024). Pengembangan Media Augmented Reality Expression Book (MAREBOO) untuk Menstimulasi Kemampuan Sosial Emosional

- Anak Usia 5-6 Tahun. *Murhum: Jurnal Pendidikan Anak Usia Dini*, 5(2), 1113-1123. <https://doi.org/10.37985/murhum.v5i2.746>
- Maharani, I. A. B. A., Agung, A. A. G., & Tirtayani, L. A. (2022). Media kartu bergambar berbantuan augmented reality (AR) untuk mengembangkan kemampuan bahasa bagi anak kelompok B. *Jurnal Pendidikan Anak Usia Dini Undiksha*, 10(3), 360-369.
- Maulidina, R., Siwiyanti, L., & Zultiar, I. (2020). Upaya Peningkatan Kemampuan Kognitif Anak Usia Dini Melalui Metode Pencampuran Warna Sederhana. *Kependidikan Jurnal Utile*, VI(1), 100-110.
- Nasution, N., Darmayunata, Y., & Wahyuni, S. (2022). Pengembangan Media Pembelajaran Anak Usia Dini berbasis Augmented Reality. *Jurnal Obsesi : Jurnal Pendidikan Anak Usia Dini*, 6(6), 6462-6468. <https://doi.org/10.31004/obsesi.v6i6.3408>
- Ondog, J., & Kilag, O. K. (2023). A Constructivist Framework for Early Grade Numeracy: Drawing on Jean Piaget's Cognitive Development Theory. *Excellencia: International Multi-disciplinary Journal of Education (2994-9521)*, 1(4), 308-320.
- Puspitasari, N., Izzati, U. A., & Darminto, E. (2022). Penerapan Media Flash Card untuk Meningkatkan Kemampuan Kognitif dan Bahasa pada Anak Usia 4-5 Tahun. *Jurnal Basicedu*, 6(5), 8545-8559. <https://doi.org/10.31004/basicedu.v6i5.3789>
- Rashevskaya, N. V., Semerikov, S. O., Zinonos, N. O., Tkachuk, V. V., & Shyshkina, M. P. (2020). Using augmented reality tools in the teaching of two-dimensional plane geometry. In Proceedings of the 3rd International Workshop on Augmented Reality in Education Kryvyi Rih, Ukraine, May 13, 2020 (No. 2731, pp. 79-90).
- Ritonga, R. S., Syahputra, Z., Arifin, D., & Sari, I. M. (2022). Pengembangan Media Pembelajaran Smart Board Berbasis Augmented Reality Untuk Pengenalan Hewan Pada Anak Usia Dini. *Jurnal PG-PAUD Trunojoyo : Jurnal Pendidikan Dan Pembelajaran Anak Usia Dini*, 9(1), 40-46. <https://doi.org/10.21107/pgpaudtrunojoyo.v9i1.13418>
- Saputra, H. N., Said, H., & Sarpina. (2024). Development of Interactive Multimedia for Introducing Letters and Numbers to Kindergarten Students. *Jurnal Smart Paud*, 7(2), 182-188. <https://doi.org/10.36709/jspauid.v7i2.178>
- Saputra, H. N., Salim, S., Idhayani, N., & Prasetyo, T. K. (2020). Augmented Reality-Based Learning Media Development. *Al-Ishlah: Jurnal Pendidikan*, 12(2), 176-184. <https://doi.org/10.35445/alishlah.v12.i2.258>
- Saputra, H. N., Salim, S., Idhayani, N., Ramadhan, D. O., & Juliasari, N. (2025). *Transformasi Pembelajaran Anak Usia Dini Menggunakan Teknologi Augmented Reality*. Retrieved from <https://getpress.co.id/product/transformasi-pembelajaran-anak-usia-dini-menggunakan-teknologi-augmented-reality>
- Sundari, S., & Margaretha, L. (2023). Pengembangan Media Augmented Reality untuk Membangun Moral Anak Usia Dini. *JiIP - Jurnal Ilmiah Ilmu Pendidikan*, 6(9), 6963-6971. <https://doi.org/10.54371/jiip.v6i9.2841>
- Wijayanti, F. D., Utomo, H. B., Wiranata, I. H., & Lestaringrum, A. (2023). Explosion Box: Media Interaktif Guna Meningkatkan Kemampuan Berpikir Logis Anak Usia Dini. *ABATA (Jurnal Pendidikan Islam Anak Usia Dini)*, 3(1), 29-38. <https://doi.org/10.32665/abata.v2i1.1391>

- Wulandari, G. A., & Ambara, D. P. (2021). Media Kartu Uno Berbasis Multimedia Interaktif pada Kemampuan Kognitif Anak Usia Dini dalam Mengenal dan Berhitung Angka. *Jurnal Pendidikan Anak Usia Dini Undiksha*, 9(2), 211. <https://doi.org/10.23887/paud.v9i2.35500>
- Yildiz, T. (2025). From Constructivism To Cultural Cognition: A Comparative Analysis Of Piaget, Vygotsky, And Tomasello's Theories Of Cognitive Development. *Humanitas-Uluslararası Sosyal Bilimler Dergisi*, 13(25), 411-429.
- Yulisar, N. A., Hibana, H., & Zubaedah, S. (2020). Pembelajaran Calistung: Peningkatkan Perkembangan Kognitif pada Kelompok B di TK Angkasa Tasikmalaya. *GOLDEN AGE: Jurnal Ilmiah Tumbuh Kembang Anak Usia Dini*, 5(1), 17-30. <https://doi.org/10.14421/jga.2020.51-01>

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