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The development of number sense as the foundation of early childhood numeracy through play-based learning

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Abstract

The development of numeracy skills in early childhood is a crucial aspect of supporting cognitive growth, particularly through strengthening *number sense* as the foundation for understanding numerical concepts. This study aims to analyze the role of play-based learning in fostering number sense in young children. The research employs a qualitative approach using a literature review design, examining 30 relevant scientific articles. Data were analyzed descriptively through processes of categorization, comparison, and synthesis of research findings. The results indicate that the development of number sense is strongly influenced by concrete, exploratory, and contextual learning experiences. Play-based learning has been proven effective in helping children understand numerical concepts through activities that involve multisensory experiences and the use of concrete materials. This process enables children to gradually construct their understanding of numeracy, moving from direct experiences toward more abstract concepts. Therefore, play-based learning is a highly relevant approach in early childhood numeracy education, as it optimizes the development of number sense while supporting children's overall cognitive development.

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INTRODUCTION

The development of numeracy skills in early childhood education (ECE) is a crucial aspect of supporting children's cognitive growth. At this stage, numeracy is not limited to counting skills, but also encompasses an understanding of number concepts, quantity, patterns, and the relationships between objects in various real-life contexts. (Adim et al., n.d.; Supriyanto, n.d.). One of the key components in numeracy development is *number sense*, which refers to children's intuitive ability to understand the meaning of numbers and the relationships between them through meaningful learning experiences. (Starr et al., 2013).

Number sense develops gradually through children's experiences as they interact with their environment and the objects around them. This ability serves as a crucial foundation for mathematics learning, as it enables children to develop a deeper understanding of numerical concepts.(Atiasih, 2025; Prayitno et al., 2023). Therefore, the stimulation of *number sense* from an early age needs to be provided appropriately so that children develop a strong foundation for mathematical thinking in subsequent stages of education. (Kristiana et al., 2022). However, numeracy practices in early childhood education (ECE) settings still face various challenges. In many learning activities, the introduction of number concepts remains oriented toward academic tasks such as recognizing number symbols, copying numbers, or memorizing number sequences. Such approaches tend to emphasize mechanical aspects, providing limited opportunities for children to develop a conceptual understanding of numbers. (Seprina et al., 2026).

In addition, numeracy learning activities in early childhood are often not linked to contextual learning experiences. Children are frequently given formal tasks such as worksheets or number-writing exercises. This condition makes the learning process less engaging and less aligned with the characteristics of young children, who essentially learn through direct experiences and play-based activities. Another issue commonly found relates to lesson planning conducted by teachers. Instructional planning is a crucial component of the educational process, as it serves as a guideline for designing systematic and well-structured learning activities.(Mrizal1,, n.d.; Stitnu, n.d.). Effective planning enables teachers to integrate learning objectives, instructional strategies, and learning activities that are aligned with children's developmental needs. (Pratiwi & Farid Utsman, n.d.). Instructional planning in early childhood education (ECE) should take into account children's developmental characteristics, as they learn through exploration, manipulation of objects, and social interaction. Learning experiences that are designed contextually provide opportunities for children to gradually construct conceptual understanding through meaningful engagement.

One relevant approach to support the development of numeracy in young children is *play-based learning*. This approach positions play as an integral part of the learning process, allowing children to learn naturally through exploration and direct experience.(Farina, 2025a; P. I. Lestari & Prima, 2019; Mawardah & Ramadhanti, 2025; Nilsson et al., 2018). Through play activities, children can develop an understanding of numerical concepts through various experiences such as counting objects, grouping items, comparing quantities, and recognizing patterns. (K. Lestari & Tinggi Keguruaan dan Pendidikan Melawi, n.d.). These activities enable children to construct their understanding of numeracy in a more contextual and meaningful way.

The implementation of *play-based learning* also provides opportunities for teachers to design more creative and innovative learning experiences in fostering young children's *number sense*. (Farina, 2025). Through well-structured instructional planning, play activities can be directed toward achieving numeracy learning objectives without diminishing the enjoyable nature of children's learning experiences.

METHOD

This study employs a qualitative approach using a literature review method. The qualitative approach is used to gain an in-depth understanding and description of the development of *number sense* as the foundation of early childhood numeracy through *play-based learning*. This research examines 30 scientific articles relevant to the topic, obtained from various sources such as national and international journals, books, and

TUNAS SILIWANGI
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Volume. 12, Number. 1, April 2026

other scholarly publications. The selection of articles was based on their relevance to the focus of the study, namely *number sense*, early childhood numeracy learning, and *play-based learning*.

The literature review process was conducted systematically through several stages, including source collection, article selection, categorization, and data analysis. The selected articles were then classified into three main categories of analysis, namely:

1. The concept and development of *number sense* in early childhood.
2. Numeracy learning in early childhood education.
3. The implementation of *play-based learning* in developing children's numeracy skills.

Data were analyzed using a descriptive qualitative technique by describing, comparing, and interpreting findings from various sources to identify patterns and relationships among concepts. Furthermore, the results of the analysis were synthesized to generate a comprehensive understanding of the role of *play-based learning* in supporting the development of *number sense* in early childhood.

RESULTS AND DISCUSSION

Result

The results of the literature review indicate that the development of numeracy skills in early childhood is strongly influenced by learning experiences that are concrete, exploratory, and aligned with children's developmental stages. *Number sense*, as the foundation of numeracy, includes an understanding of number concepts, relationships between numbers, and the ability to use numbers in everyday contexts.

The findings also show that learning activities utilizing concrete and multisensory materials significantly enhance children's ability to understand numerical concepts. The use of *number sense* media that engage visual, auditory, kinesthetic, and tactile modalities provides more meaningful learning experiences, enabling children to grasp numerical concepts more concretely and effectively.(Fitri & Kholid, 2020) .

In addition, the use of manipulative materials such as the *five-frame* has also been shown to support the development of *number sense*, particularly in helping children understand fundamental counting principles such as one-to-one correspondence, number sequencing, and cardinality. This medium provides a visual structure that helps children organize quantities and connect them with number symbols. (McGuire et al., 2012).

In the context of *play-based learning*, the use of open-ended materials such as *loose parts* provides children with opportunities to explore freely. Children can group, count, compare, and arrange objects based on their own understanding, allowing numeracy concepts to develop naturally through direct experience.

The findings also indicate that the Montessori approach, which emphasizes learning through sensory activities—particularly tactile experiences—is highly effective in supporting the development of *number sense*. Children learn numerical concepts by manipulating real objects, such as touching, moving, and grouping materials, making abstract concepts easier to understand.

Overall, the results suggest that effective numeracy learning in early childhood is characterized by the integration of play-based approaches, the use of concrete materials, and multisensory experiences that actively engage tactile aspects in the learning process.

Discussion

The findings of the study indicate that numeracy learning in early childhood should be oriented toward concrete experiences and meaningful activities. (Fidesrinur et al., 2025; Khasanah et al., n.d.). Learning that places excessive emphasis on number symbols and formal academic activities tends to be misaligned with children's developmental stages, thereby hindering the development of *number sense*. Young children require learning experiences that involve exploration and direct interaction with objects. (Alfadhilah, n.d.; Sestrix C Rahabav & Mirdayati Aihena, 2025).

TUNAS SILIWANGI
P-ISSN : 2476-9789 E-ISSN: 2581-0413
Volume. 12, Number. 1, April 2026

Your sentence is already clear and appropriate. Here is a slightly refined version for a smoother academic tone:The *play-based learning* approach is highly relevant, as it enables children to learn naturally through play-based activities.

(Nilsson et al., 2018). During play, children indirectly develop numeracy skills such as counting, comparing, classifying, and recognizing patterns. These activities help children gradually build a contextual understanding of numerical concepts. The use of *loose parts* in play-based learning provides children with the flexibility to explore various possibilities in using objects. (Oviani, n.d.; Valentina Dewi et al., 2023). Children can use simple objects to construct numeracy concepts, such as arranging quantities, creating patterns, or comparing sizes. This process aligns with constructivist theory, in which children build knowledge through direct experience.

The Montessori approach also reinforces the importance of using concrete materials and sensory experiences in numeracy learning. (Putrihana99,+7708-771.)Montessori emphasizes that learning experiences involving the senses—particularly the tactile sense—help children develop a deeper understanding of concepts. When children touch, feel, and manipulate objects, they do not merely see numbers as symbols, but also grasp the meaning behind those numbers. (Kholid, 2020).

In addition, the use of media such as the *five-frame* demonstrates that a simple visual structure can help children understand fundamental *number sense* concepts. This medium serves as a bridge between concrete experiences and abstract understanding, enabling children to develop their counting skills in a more systematic way. (McGuire et al., 2012)

The integration of play-based learning approaches, the use of *loose parts*, and Montessori principles that emphasize tactile experiences indicates that effective numeracy learning should be holistic in nature.(Tk et al., n.d.). Children do not learn solely through seeing and listening, but also through direct action and sensory experiences.

The development of number sense in early childhood can be optimized through play-based learning that integrates concrete materials, open-ended exploration using loose parts, and tactile experiences aligned with Montessori principles. (Tk et al., n.d.). This approach not only enhances numeracy skills but also supports children's overall cognitive development. (Nuza Hery Setyani et al., 2023; Rohmah, 2025; Romadhona & Rohmah, 2025).

CONCLUSION

The development of *number sense* is a fundamental basis for shaping young children's numeracy skills in both conceptual and contextual ways. The findings of this review indicate that effective numeracy learning should be grounded in concrete, exploratory learning experiences that are aligned with children's developmental stages. The *play-based learning* approach facilitates this process through meaningful play activities that engage multiple senses.

The use of concrete and visual learning media, along with activities that allow children to directly manipulate objects, has been shown to help children gradually understand numerical concepts, moving from concrete to abstract thinking. Therefore, the integration of play-based learning, the use of relevant instructional media, and systematic lesson planning are key factors in optimizing the development of *number sense* while supporting children's overall cognitive development.

REFERENCES

Adim, M., Yuli Mestika, I., Bahri, S., Stkip, P., & Sumenep, P. (n.d.). *ANALISIS KEMAMPUAN NUMERASI SISWA PADA PEMBELAJARAN MATEMATIKA KELAS III DI SDN BRAJI*.

Alfadhilah, J. (n.d.). *Filsafat Pendidikan Anak Usia Dini Menurut Jean Piaget*.

Atiasih. (2025). *Jurnal Syntax Imperatif: Jurnal Ilmu Sosial dan Pendidikan A R T I C L E I N F O*

TUNAS SILIWANGI
P-ISSN : 2476-9789 E-ISSN: 2581-0413
Volume. 12, Number. 1, April 2026

Inovasi Pembelajaran Matematika Anak Usia Dini Berbasis STEAM Melalui Media Loose Parts untuk Membangun Kompetensi Abad 21. *6*(4), 1104–1113. https://doi.org/10.5453/syntaximperatif.v6i4.795

Farina, M. (2025a). *PEMANFAATAN LINGKUNGAN ALAM SEBAGAI SUMBER BELAJAR ANAK*. *2*(7), 3003–3011. https://doi.org/10.62335

Farina, M. (2025b). *PEMANFAATAN LINGKUNGAN ALAM SEBAGAI SUMBER BELAJAR ANAK*. *2*(7), 3003–3011. https://doi.org/10.62335

Fidesrinur, F., Fitria, N., Lestari, A., & Riza, E. (2025). Upaya Meningkatkan Kemampuan Numerasi Awal Anak Usia 5-6 Tahun melalui Media Zoo Math Pack. *Jurnal Obsesi : Jurnal Pendidikan Anak Usia Dini*, *9*(3), 809–821. https://doi.org/10.31004/obsesi.v9i3.6748

Khasanah, I., Pusari, R. W., Rakhmawati, I., & Putriyanti, L. (n.d.). *MENANAMKAN LITERASI DAN NUMERASI SEJAK DINI MELALUI ETNOMATEMATIKA: SUATU DESAIN MODEL PEMBELAJARAN BERBASIS BUDAYA*. https://doi.org/10.26877/malihpeddas.v15i2.25491

Kholid, R. F. (2020). MEDIA NUMBER SENSE UNTUK MENGENALKAN BILANGAN PADA ANAK USIA DINI DENGAN MULTISENSORI. *J Urnal Pendidikan*, *5*.

Kristiana, D., Jumadi, J., & Nurhidayah, D. A. (2022). Pelatihan Pembuatan Media Number sense Bagi Guru PAUD Aisyiyah. *Dedication : Jurnal Pengabdian Masyarakat*, *6*(1), 1–6. https://doi.org/10.31537/dedication.v6i1.650

Lestari, K., & Tinggi Keguruaan dan Pendidikan Melawi, S. (n.d.). *Penerapan Konsep Matematika Pada Anak Usia Dini*.

Lestari, P. I., & Prima, E. (2019). Peran Ruang Publik Terpadu Ramah Anak Bagi Anak Usia Dini. *Jurnal Obsesi : Jurnal Pendidikan Anak Usia Dini*, *4*(1), 483. https://doi.org/10.31004/obsesi.v4i1.396

Mawardah, M., & Ramadhanti, S. D. (2025). Metode Pembelajaran Berbasis Bermain pada Anak Usia Dini di TK/MI YASPA Palembang. *AJAD : Jurnal Pengabdian Kepada Masyarakat*, *5*(2), 297–304. https://doi.org/10.59431/ajad.v5i2.559

McGuire, P., Kinzie, M. B., & Berch, D. B. (2012). Developing Number Sense in Pre-K with Five-Frames. *Early Childhood Education Journal*, *40*(4), 213–222. https://doi.org/10.1007/s10643-011-0479-4

mrizal1,+122.+27630-Article+Text-96103-1-4-20240502. (n.d.).

Nilsson, M., Ferholt, B., & Lecusay, R. (2018). 'The playing-exploring child': Reconceptualizing the relationship between play and learning in early childhood education. *Contemporary Issues in Early Childhood*, *19*(3), 231–245. https://doi.org/10.1177/1463949117710800

Nuza Hery Setyani, Ari Handayani, & Dini Rahmawati. (2023). Pengembangan Keterampilan Numerasi Dan Kemampuan Kognitif Pada Anak Usia Dini Melalui Media Pembelajaran Menggunakan Bahan Alam. *Jurnal Insan Pendidikan Dan Sosial Humaniora*, *1*(3), 55–73. https://doi.org/10.59581/jipsoshum-widyakarya.v1i3.776

Oviani, M. (n.d.). *Pengaruh Penggunaan Media Loose Part terhadap Perkembangan Kognitif*.

Pratiwi, E. S., & Farid Utsman, A. (n.d.). PERENCANAAN PEMBELAJARAN DALAM PENDIDIKAN ANAK USIA DINI. *P-ISSN*, *2*(2), 232–240. https://doi.org/10.32665/abata.v2i1.881

Prayitno, L. L., Mutianingsih, N., & Insani, A. (2023). Membangun Number Sense pada Anak TK A berdasarkan sudut pandang Semantik. *Jurnal Obsesi : Jurnal Pendidikan Anak Usia Dini*, *7*(6), 7525–7536. https://doi.org/10.31004/obsesi.v7i6.4460

putrihana99,+7708-7712. (n.d.).

Rohmah, U. (2025). Perkembangan dan Pendidikan Kemampuan Kognitif Anak Usia Dini. *Jurnal*

TUNAS SILIWANGI
P-ISSN : 2476-9789 E-ISSN: 2581-0413
Volume. 12, Number. 1, April 2026

Obsesi : Jurnal Pendidikan Anak Usia Dini, *9*(1), 130–138. https://doi.org/10.31004/obsesi.v9i1.5918

Romadhona, A., & Rohmah, lailatu. (2025). Model Pembelajaran Literasi dan Numerasi Dini di Pendidikan Anak Usia Dini: systematic Literature review. In *Jurnal Pendidikan Islam Anak Usia Dini* (Vol. 3, Number 2).

Seprina, A., Rachmadini, I. M., Putri, R. F., Sumaya, A., Amelia, E., Utami, W. S., Kunci, K., Numerasi, :, & Dini, A. U. (2026). Peningkatan Kemampuan Numerasi Anak Usia Dini Melalui Media Flashcard. *Jurnal Pendidikan Anak Usia Dini*, *3*(2), 1–8. https://doi.org/10.47134/paud.v3i2.2366

Sestrix C Rahabav, & Mirdayati Aihena. (2025). Implementasi Pembelajaran Bermain Berbasis Lingkungan dalam Mengembangkan Aspek Perkembangan Anak Usia Dini di PAUD Mawar. *JURNAL RISET RUMPUN ILMU PENDIDIKAN*, *4*(3), 673–683. https://doi.org/10.55606/jurripen.v4i3.8397

Starr, A., Libertus, M. E., & Brannon, E. M. (2013). Number sense in infancy predicts mathematical abilities in childhood. *Proceedings of the National Academy of Sciences of the United States of America*, *110*(45), 18116–18120. https://doi.org/10.1073/pnas.1302751110

stitnu,+Journal+manager,+1.+Nadlir-edit. (n.d.).

Supriyanto. (n.d.). *Urgensi Pengenalan Literasi Numerasi pada Anak Usia Dini: Dampak terhadap Kemampuan Matematika di SD dan Kesiapan Sekolah*.

Tk, D., Madani, K., Faizah, S. N., Guru, P., Anak, P., Dini, U., Rinakit, K., & Pendidikan, A. (n.d.). *Upaya Peningkatan Kemampuan Numerasi Melalui Media Loose Part* (Vol. 12, Number 1). Retrieved https://ejournal.unesa.ac.id/index.php/paud-teratai/index

Valentina Dewi, E. R., Hibana, H., & Ali, M. (2023). Pengaruh Penggunaan Media Loose Parts terhadap Perkembangan Kognitif Anak Usia Dini. *Jurnal Obsesi : Jurnal Pendidikan Anak Usia Dini*, *7*(1), 267–282. https://doi.org/10.31004/obsesi.v7i1.3451