JURNAL INDRIA
Jurnal Ilmiah Pendidikan PraSekolah dan Sekolah Awal
Vol. 11 No. 1 Maret 2026
http://journal.umpo.ac.id/index.php/indria/index

Bolpin (Smart Ball): An Interactive Tool to Improve Reading and Writing Literacy in Early Childhood Education

*Mardiyah[1], Ahmad Samawi[2], Sri Wahyuni[3]
[1,2,3] Universitas Negeri Malang

Article Information

Article Hsitory
Received: Jan 01, 2026
Revised: Feb 3, 2026
Accepted: March 13, 2026

Keywords:
Bolpin (Smart Ball)
interactive media
early childhood literacy
early childhood
play-based learning

Abstrak

Pendidikan anak usia dini (PAUD) merupakan fase krusial dalam menumbuhkan literasi dasar, khususnya kemampuan membaca dan menulis. Literasi perlu dikembangkan sejak dini untuk mendukung kesiapan belajar anak. Pembelajaran anak usia dini berlandaskan prinsip belajar melalui bermain yang menekankan keterlibatan aktif dan pengalaman langsung. Namun, praktik pembelajaran literasi di PAUD masih sering didominasi pendekatan konvensional yang berfokus pada lembar kerja dan buku, sehingga kurang mendorong partisipasi aktif anak. Kondisi ini berdampak pada rendahnya minat dan motivasi belajar ketika kegiatan pembelajaran tidak didukung media yang menarik. Penelitian ini bertujuan mengembangkan media pembelajaran Bolpin (Bola Pintar) berbasis pendekatan interaktif serta menguji efektivitasnya dalam meningkatkan kemampuan membaca dan menulis anak usia dini. Penelitian menggunakan metode Research and Development (R&D) dengan prosedur ADDIE yang meliputi tahap analysis, design, development, implementation, dan evaluation. Subjek penelitian adalah anak kelompok B di RA Miftahul Huda II Sengonagung Purwosari, Kabupaten Pasuruan. Teknik pengumpulan data meliputi observasi, wawancara, dan dokumentasi. Kelayakan media dinilai melalui validasi ahli materi dan ahli media, sedangkan efektivitas diuji menggunakan desain pre-eksperimental dengan analisis N-Gain berdasarkan hasil pretest dan posttest. Hasil penelitian menunjukkan bahwa media Bolpin dinyatakan sangat valid, dengan persentase validasi ahli media sebesar 93% dan ahli materi sebesar 92%. Penerapan media Bolpin meningkatkan kemampuan membaca dan menulis anak, dengan nilai N-Gain sebesar 0,67 (kategori sedang). Media Bolpin efektif mendukung pembelajaran literasi yang aktif dan menyenangkan.

Abstract

Early childhood education (PAUD) is a crucial phase in developing basic literacy, especially reading and writing skills. Literacy needs to be developed early on to support children's readiness to learn. Early childhood learning is based on the principle of learning through play, which emphasizes active involvement and direct experience. However, literacy learning practices in PAUD are still often dominated by conventional approaches that focus on

worksheets and books, thereby failing to encourage active participation from children. This situation results in low interest and motivation to learn when learning activities are not supported by engaging media. This study aims to develop Bolpin (Smart Ball) learning media based on an interactive approach and to test its effectiveness in improving the reading and writing skills of early childhood. The study uses the Research and Development (R&D) method with the ADDIE procedure, which includes the stages of analysis, design, development, implementation, and evaluation. The research subjects were children in group B at RA Miftahul Huda II Sengonagung Purwosari, Pasuruan Regency. Data collection techniques included observation, interviews, and documentation. The feasibility of the media was assessed through validation by subject matter experts and media experts, while its effectiveness was tested using a pre-experimental design with N-Gain analysis based on pretest and posttest results. The results of the study showed that Bolpin media was declared highly valid, with a media expert validation percentage of 93% and a subject matter expert validation percentage of 92%. The application of Bolpin media improved children's reading and writing skills, with an N-Gain value of 0.67 (moderate category). Bolpin media is effective in supporting active and enjoyable literacy learning.

✉ Corresponding author
E-mail: mardiyah.2401548@student.um.ac.id

ISSN 2579-7255 (Print)
ISSN 2524-004X (Online)

INTRODUCTION

Early childhood education (PAUD) is a fundamental phase in the development of literacy, particularly early reading and writing skills (Mawaddah, 2024). The development of early childhood literacy has become a priority in national policy, notably through the Merdeka Curriculum and the National Literacy Movement, which position literacy as the foundation for character development and 21st-century skills (Lukum et al., 2024). In theory, early childhood education should be based on the principle of learning through play, which emphasizes active engagement, hands-on experiences, and stimulation appropriate to children's developmental characteristics. This principle aligns with the theories of Piaget and Vygotsky, which emphasize that children learn best through social interaction, real-world experiences, and meaningful play activities (Mudlofir, 2021). However, in practice, there remains a gap between theory and reality on the ground. Literacy learning activities in early childhood education are still often dominated by conventional approaches. Learning activities

typically focus on worksheets, memorizing letters, and other repetitive tasks that tend to be monotonous, thereby failing to encourage children's active participation. Such approaches are unable to provide meaningful learning experiences due to a lack of stimulation and are not fully aligned with the developmental characteristics of young children. Literacy challenges in early childhood education are also influenced by the limited availability of age-appropriate learning materials, resulting in children receiving insufficient meaningful learning experiences. Various findings indicate that a less interactive approach results in low interest, reduced motivation for reading and writing, and limited child engagement in literacy activities, leading to many children still struggling to recognize letters, expand their basic vocabulary, or understand simple words. Consequently, there is a need for innovative learning media capable of bridging the gap between early childhood education pedagogical principles and literacy teaching practices in the classroom. (Patriasih et al., 2025).

Various previous studies have examined the development of media and learning strategies for early childhood literacy. Previous studies have shown that interactive and game-based media have a positive impact on the development of early reading and writing skills (Zulkarnain, 2024). Other studies confirm that actively engaging children through hands-on activities can boost their motivation and literacy learning outcomes (Zheng et al., 2024). Nevertheless, most research still focuses on learning methods or models, while studies on concrete, integrative media that are easy for teachers to implement remain limited. Furthermore, there has been little research specifically developing simple game-based media that simultaneously integrates motor, cognitive, and language elements. Therefore, this study serves to both reinforce and build upon previous research by emphasizing the innovation of learning media that is contextual, practical, and aligned with the literacy learning needs in early childhood education (PAUD).

The novelty of this study lies in the development of the Bolpin (Smart Ball) as an interactive tool designed to integrate play with the stimulation of reading and writing literacy (Chuang & Jamiat, 2023). This medium serves not only as a visual aid but also as a tool for hands-on activities that encourage children's physical and cognitive engagement. Unlike conventional literacy materials, Bolpin combines elements of play, exploration, and multisensory learning experiences that align with the characteristics of young children. The development of this medium is based on learning needs that demand active, enjoyable, and meaningful learning experiences. With this approach, this study offers conceptual and

practical contributions to the development of literacy learning media in early childhood education. In conclusion, the Bolpin innovation is the key distinguishing feature of this study and simultaneously offers an alternative solution to the limitations of the literacy media traditionally used in the classroom.

Based on this background, this study aims to examine the effectiveness of the Bolpin medium in the context of early childhood literacy learning. The main issues this study seeks to address are formulated as research questions: How suitable is the Bolpin medium as a literacy learning tool in early childhood education? How effective is the Bolpin medium in improving early reading skills among young children? How effective is the Bolpin media in improving early writing skills in early childhood? These questions were formulated to obtain a comprehensive picture of the media's contribution to the learning process and outcomes. Thus, this study focuses not only on product development aspects but also on empirical testing of the impact of media use in literacy learning.

This study is based on the argument that play-based interactive learning materials can enhance engagement, motivation, and literacy skills in young children (Aslan et al., 2022). Conceptually, learning that involves hands-on activities and direct experiences enables children to develop a deeper understanding (Yousef, 2021). Empirical evidence from previous research indicates that interactive media has a positive impact on the development of early literacy (Alotaibi, 2024). Therefore, the Bolpin medium is believed to provide more effective stimulation than conventional approaches. This argument underscores that integrating play and literacy is a strategy well-suited to the developmental characteristics of young children (Rand & Morrow, 2021). In conclusion, the effectiveness of the Bolpin medium needs to be systematically tested to obtain scientific evidence regarding its contribution to improving early reading and writing skills in young children.

LITERATURE REVIEWS

Literature from the past decade indicates a paradigm shift in early childhood literacy education, moving away from conventional academic approaches toward more contextual, interactive, and play-based learning. Various studies confirm that early literacy is no longer understood merely as the technical ability to read and write, but rather as an integrated process of language, symbolic, and cognitive development that is intertwined with children's learning experiences (Clemente-Suárez et al., 2024; Liu et al., 2023). This perspective views children

as active learners who construct understanding through interaction with their environment and concrete materials. Consistent with this, empirical studies show that the use of interactive materials contributes to increased attention, motivation, and engagement among children in early literacy activities (Chuang & Jamiat, 2023; Ewin et al., 2021). These findings consistently show that the learning characteristics of young children require an approach that is not abstract, but rather hands-on and multisensory.

Other studies support the argument that learning materials play a strategic role in shaping the quality of literacy learning experiences. Concrete materials are considered capable of bridging the gap between the abstract process of recognizing letter symbols and a more meaningful experience (Donovan & Fyfe, 2022; Kampeza & Delserieys Pedregosa, 2024). Manipulative activities, visually engaging tasks, and hands-on exploration have been shown to support the development of fine motor skills as well as early writing readiness (Lo & Wang, 2024; Martino & Lape, 2021). In addition, studies on interactive media innovations show that emotional engagement and the enjoyment of learning are key factors in helping children stay focused (Malone & Lepper, 2021; Simatupang & Bui, 2025). However, some studies also note that the implementation of educational media is often less than optimal due to limitations in teachers' creativity, the availability of media, and pedagogical understanding (Rachmadtullah et al., 2023).

In the context of educational policy and practice, national regulations also underscore the importance of child-centered and play-based learning. Early childhood education guidelines emphasize the need for active, exploratory, and meaningful learning experiences (Kemendikbudristek, 2022). Recent studies also show that interactive media innovations can serve as a solution to the current trend of learning that remains dominated by worksheets and passive activities (Fajrie, 2023; Chuang & Jamiat, 2023). In general, research trends reveal a consistent pattern: the effectiveness of literacy instruction is strongly influenced by the quality of learning interactions, the meaningfulness of the experience, and the appropriateness of the media to children's developmental characteristics (Utamimah et al., 2024). Thus, the development of interactive media such as Bolpin has a strong theoretical and empirical foundation in contemporary literature.

METHOD

This study employs a research and development (R&D) design aimed at producing an interactive educational media product called Bolpin (Smart Ball) while also testing its feasibility and effectiveness in improving early reading and writing literacy skills among young children. The development approach used is based on the ADDIE model, which includes the stages of analysis, design, development, implementation, and evaluation. (Slamet, 2022). This design choice was based on the nature of the research, which not only focused on testing variables but also emphasized a systematic process in designing, validating, revising, and implementing learning materials. By using the ADDIE model, each stage of Bolpin media development was carried out in a structured manner, ranging from identifying literacy learning needs in the classroom, drafting the media design, producing the media, to evaluating the effectiveness of its use. This approach ensures that the developed media is not only theoretically valid but also practically relevant to the literacy learning needs of young children.

The data in this study consists of qualitative and quantitative data that complement each other in describing the process and outcomes of media development. Qualitative data was used to gain a deep understanding of the initial conditions of literacy learning, children's learning characteristics, and the responses of both teachers and children to the use of the Bolpin media. This data provides a contextual picture of the dynamics of learning that cannot be fully explained through numbers alone. Meanwhile, quantitative data was used to measure the level of improvement in children's early reading and writing skills before and after the use of the media. Research data sources include early childhood students in Group B at RA Miftahul Huda II Sengonagung as the primary research subjects, classroom teachers as supporting informants, and relevant learning documents, such as lesson plans and children's work samples. The combination of these two types of data allows researchers to obtain a comprehensive picture of the media's suitability and effectiveness.

Data collection was conducted using observation, interviews, questionnaires, and documentation. Observation was used to directly observe children's learning activities, attention levels, engagement, interactions, and literacy skill development during the use of the Bolpin media in learning activities. This technique allowed researchers to capture learning phenomena that emerged naturally in the classroom. Interviews were conducted with classroom teachers to obtain information regarding the initial conditions of literacy learning,

challenges faced, and perceptions regarding the use of interactive media. Questionnaires were used in the needs analysis and expert validation stages to assess the media's feasibility, including design clarity, content appropriateness, safety, and ease of use. Documentation was used to supplement research data in the form of photos of activities, learning materials, and children's work products. The use of these various techniques aims to enhance data accuracy through triangulation of methods and sources.

Data analysis techniques were conducted using both descriptive and inferential methods, depending on the characteristics of the data obtained. Qualitative data were analyzed through the stages of data reduction, data presentation, and drawing conclusions to describe the media development process, user responses, and the learning dynamics that occurred during implementation. This analysis emphasized the interpretation of meaning regarding the observed phenomena. Quantitative data were analyzed by comparing the pretest and posttest results of children's early reading and writing skills. This comparison was used to identify changes resulting from the use of the Bolpin media. To determine the media's effectiveness in improving literacy skills, an N-Gain analysis was employed. This technique provides an objective measure of the extent of improvement in children's skills, thereby allowing the media's effectiveness to be explained in a measurable and systematic manner.

The assessment of early reading literacy skills is based on indicators relevant to the developmental stages of young children, namely the ability to recognize letter symbols, associate letters with sounds, and read simple symbols or words. Early writing skills are assessed through indicators such as the ability to imitate letter shapes, the skill of writing simple symbols, and the development of fine motor coordination that supports writing activities. The research instruments were designed by considering the cognitive, language, and motor development characteristics of young children to ensure they align with their abilities and learning experiences. To ensure the quality of the instruments, validation was conducted by experts who assessed the appropriateness of the indicators, the clarity of the language, and the readability of the instruments. This process aims to ensure that the instrument used is truly capable of accurately representing children's literacy skills. Consequently, the data obtained possess conceptual validity and empirical relevance in explaining the effectiveness of the Bolpin medium.

RESULTS AND DISCUSSION

1. RESULTS

The development of the Bolpin (Smart Ball) educational media was carried out using the Research and Development (R&D) method with the ADDIE model, which includes the Analysis, Design, Development, Implementation, and Evaluation stages. The Bolpin media was designed as a game-based interactive tool aimed at supporting early reading and writing literacy for young children. The development of this media is based on learning needs that emphasize play-based activities, active child engagement, and concrete learning experiences. This educational tool was developed with a focus on visual appeal, safety, ease of use, and relevance to literacy learning objectives. The final product is a hands-on educational tool that enables children to engage in manipulative, exploratory, and participatory activities. Conceptually, the Bolpin media is designed to integrate play with literacy stimulation, ensuring that learning does not occur passively. As such, this media is expected to create a learning environment that is more interactive, engaging, and aligned with the developmental characteristics of young children.

The suitability of the Bolpin media was evaluated through a validation process involving media experts and content experts. The results of the media experts' validation showed a suitability rate of 93%, while the content experts' validation yielded a rate of 92%; both fall into the "highly valid" category. The suitability assessment covered aspects of media design, visual clarity, content appropriateness, safety of use, and the media's relevance to early childhood literacy learning. The validators stated that the Bolpin media has good visual appeal, is easy to use in learning activities, and is suitable for the learning needs of early childhood. Additionally, the media was assessed as capable of supporting manipulative and interactive activities relevant to the principles of play-based learning. These findings indicate that the Bolpin media meets the feasibility criteria both conceptually and practically. Thus, the Bolpin media is deemed suitable for implementation in early reading and writing literacy instruction.

The effectiveness of the Bolpin medium was analyzed by comparing pretest and posttest results using the N-Gain calculation. The pretest score was 503, while the posttest score increased to 730, with a maximum score of 840. The N-Gain calculation yielded a

score of 0.67, which falls into the moderate category. These results indicate an improvement in children's early reading and writing literacy skills following the use of the Bolpin medium. The increase in scores suggests that the medium makes a positive contribution to children's learning outcomes. Quantitatively, the N-Gain value reflects that learning with the Bolpin medium is capable of improving literacy skills at a meaningful level. These findings demonstrate that game-based interactive media can serve as an effective learning stimulus. Thus, the Bolpin media has proven effective in supporting literacy learning in early childhood.

Table 1: Results of the N-Gain Analysis

Components	Value
Pretest Score	503
Posttest Score	730
Maximum Value	840
N-Gain	0,67
Category	Currently

Observations during the implementation of the Bolpin method revealed positive changes in the learning process. The children appeared more focused, demonstrated more sustained attention, and actively participated in early reading and writing activities. In reading activities, children recognize letter symbols more quickly and are able to match letters with sounds more accurately. In writing activities, children appear more focused when copying and writing letter forms, with increasingly developed fine motor skills. Observations also indicate that the learning environment has become more dynamic, interactive, and less monotonous. Children demonstrate more positive learning responses, including increased interest, motivation, and engagement during literacy activities. Overall, the observational data reinforce the quantitative findings that the use of Bolpin media contributes to improved quality in both the process and outcomes of early childhood literacy learning.

2. DISCUSSION

The research findings indicate that children demonstrate higher levels of attention, engagement, and motivation when literacy instruction is designed around hands-on activities, visually engaging materials, and direct learning experiences. These findings are

consistent with a body of literature that emphasizes that early childhood education should be grounded in the principle of learning through play (Parker et al., 2022; Saracho, 2023). Theoretically, the constructivist approach views children as active participants who construct their understanding through interaction with the learning environment, rather than merely receiving information (Karwasz & Wyborska, 2023; Mitry, 2021). Game-based interactive media allows children to engage both physically and cognitively, making the learning process more meaningful. Previous research has also shown that the use of concrete materials and multisensory activities contributes to improved focus, interest, and learning responses in children during early literacy activities (Kucirkova & Rodriguez-Leon, 2023; Mubarroroh et al., 2023; Sandy et al., 2022). These findings indicate that the Bolpin medium is capable of meeting children's learning needs, which require hands-on experiences, visual stimulation, and exploratory activities. Thus, the results of this study reinforce the argument that the integration of interactive media into literacy instruction is a relevant and effective strategy in the context of early childhood education.

Conceptually, the increased attention and engagement of children in literacy learning can be explained by the characteristics of interactive media, which simultaneously integrate visual, motor, and cognitive elements. Bolpin Media provides concrete stimuli that allow children to learn through hands-on activities, transforming the learning process from a passive to an active one. Children do not merely observe but also manipulate the media, explore letter symbols, and engage in a more dynamic learning experience. This fosters a participatory learning structure, where children's physical and mental engagement becomes an integral part of the learning process. The literature confirms that multisensory learning plays a crucial role in helping children build a more stable and meaningful conceptual understanding. (Kucirkova & Rodriguez-Leon, 2023). Manipulative activities also support fine motor coordination, which is closely linked to early writing readiness (Chandler et al., 2021; Martino & Lape, 2021). Therefore, the effectiveness of Bolpin media is influenced not only by its visual appeal but also by its alignment with early childhood learning mechanisms, which emphasize hands-on experiences, active interaction, and exploration.

The implications of these research findings suggest that the use of play-based interactive media plays a strategic role in improving the quality of literacy learning among young children (Dinnocenzo, 2024; Latifah et al., 2025). Learning media are no longer

viewed merely as visual aids, but rather as essential components that shape the dynamics of classroom learning interactions. The use of concrete media such as Bolpin has proven effective in creating a more active, varied, and participatory learning environment. Without the support of appropriate media, literacy instruction risks becoming monotonous, unengaging, and unable to optimally stimulate children's involvement. Conversely, the use of interactive media allows children to be directly involved in learning activities, making the learning process more meaningful. The literature confirms that a learning environment rich in stimuli and hands-on experiences contributes to increased motivation, attention, and learning responses in children (S. Li et al., 2023; Y. Li et al., 2024). These findings underscore the importance of media innovation in early childhood education as a pedagogical strategy that supports children's developmental characteristics while enhancing the effectiveness of early reading and writing instruction.

The cause-and-effect relationship observed in this study indicates that children's active engagement significantly contributes to improved early reading and writing literacy. Manipulative activities facilitated through the Bolpin medium allow children to build concrete learning experiences, so that the process of recognizing letter symbols does not take place in an abstract manner. Direct experience provides opportunities for children to observe, touch, manipulate, and connect letter symbols with sounds in a more meaningful way. The literature confirms that physical and cognitive engagement in early childhood learning plays a crucial role in strengthening conceptual understanding and learning retention (Alhebaishi et al., n.d.; McGowan et al., 2024). In addition, activities that involve fine motor coordination also help prepare children for early writing (Chandler et al., 2021; Polsley et al., 2022). This active engagement fosters a more natural learning process, in which children gain understanding through exploration and direct interaction with the media. Thus, the Bolpin media can be understood as a pedagogical factor that not only enhances motivation and attention but also reinforces a literacy learning framework aligned with the developmental characteristics of young children. These findings indicate that the effectiveness of literacy learning is significantly influenced by the quality of the learning experiences provided to children.

CONCLUSION

Research shows that the use of the Bolpin (Smart Ball) interactive media has a significant positive impact on improving the reading and writing skills of young children. The main finding of this study is that learning designed in the form of physical play makes children more active—cognitively, physically, and emotionally. Children demonstrate gradual and continuous development of literacy skills in each session. The learning environment is also more lively, enjoyable, and interactive. Teachers also find it easier because Bolpin can be customized to various topics and children's developmental levels. The conclusion of this study is that literacy learning does not have to be conventional and boring, but can be conducted in an enjoyable way through meaningful games that are contextually appropriate.

From a scientific perspective, this study makes an important contribution to updating literacy teaching methods for young children through interactive physical media that combine cognitive and social-emotional aspects. This study also offers new insights into the effectiveness of non-digital learning media, a topic previously underrepresented in the literature. However, this study has several limitations: it was conducted at a single location, with participants limited in terms of age and socioeconomic background. Additionally, the study has not yet thoroughly explored differences between boys and girls. Therefore, further research with a broader scope is needed, involving various age groups, genders, and different regions. Such research should also employ large-scale survey or experimental methods to provide a more comprehensive picture. Findings from such studies are expected to serve as a foundation for developing more relevant educational policies aimed at promoting early childhood literacy on a national scale.

ACKNOWLEDGEMENT

Praise and thanks be to Allah SWT for His blessings and mercy, which have enabled the successful completion of this article. My deepest gratitude goes to my beloved parents for their prayers and love, which have always been a source of strength. Thank you to Mr. Samawi, M.Pd., and Mrs. Sri Wahyuni, S.Pd., M.Pd., for providing constructive criticism and suggestions that enabled this research to be completed. To my beloved husband, Muhammad Taufik, who has always been patient in offering support and encouragement, as well as to my children, Dani and Iqbal, who are a source of motivation and inspiration. I would also like to

thank my fellow students in the D24 Early Childhood Education (PAUD) Master's program, who have served as a support system in successfully completing this article

REFERENCES

Alhebaishi, S., Stone, R., & Ameen, M. (n.d.). *Emotional Engagement and Teaching Innovations for Deep Learning and Retention in Education: A*.

Alotaibi, M. S. (2024). Game-based learning in early childhood education: a systematic review and meta-analysis. *Frontiers in Psychology*, *15*, 1307881.

Aslan, S., Agrawal, A., Alyuz, N., Chierichetti, R., Durham, L. M., Manuvinakurike, R., Okur, E., Sahay, S., Sharma, S., & Sherry, J. (2022). Exploring kid space in the wild: a preliminary study of multimodal and immersive collaborative play-based learning experiences. *Educational Technology Research and Development*, *70*(1), 205–230.

Chandler, M. C., Gerde, H. K., Bowles, R. P., McRoy, K. Z., Pontifex, M. B., & Bingham, G. E. (2021). Self-regulation moderates the relationship between fine motor skills and writing in early childhood. *Early Childhood Research Quarterly*, *57*, 239–250.

Chuang, C., & Jamiat, N. (2023). A systematic review on the effectiveness of children's interactive reading applications for promoting their emergent literacy in the multimedia context. *Contemporary Educational Technology*, *15*(2), ep412.

Clemente-Suárez, V. J., Beltrán-Velasco, A. I., Herrero-Roldán, S., Rodriguez-Besteiro, S., Martínez-Guardado, I., Martín-Rodríguez, A., & Tornero-Aguilera, J. F. (2024). Digital device usage and childhood cognitive development: Exploring effects on cognitive abilities. *Children*, *11*(11), 1299.

Dewayani, S. (2017). *Menghidupkan literasi di ruang kelas*. PT Kanisius.

Dinnocenzo, E. C. (2024). *Preschool Teachers' Perceptions of the Development of Literacy Skills in a Play-Based Learning Environment*. Walden University.

Donovan, A. M., & Fyfe, E. R. (2022). Connecting concrete objects and abstract symbols promotes children's place value knowledge. *Educational Psychology*, *42*(8), 1008–1026.

Ewin, C. A., Reupert, A. E., McLean, L. A., & Ewin, C. J. (2021). The impact of joint media engagement on parent–child interactions: A systematic review. *Human Behavior and Emerging Technologies*, *3*(2), 230–254.

Fajrie, N. (2023). *Konsep Perkembangan Anak dalam Paradigma Pembelajaran*. Penerbit NEM.

Kampeza, M., & Delserieys Pedregosa, A. (2024). Symbolic representation of young children in science: Insights into preschoolers' drawings of change of state of matter. *Education Sciences*, *14*(10), 1080.

Karwasz, G. P., & Wyborska, K. (2023). How constructivist environment changes

perception of learning: Physics is fun. *Education Sciences*, *13*(2), 195.

Kucirkova, N., & Rodriguez-Leon, L. (2023). Multisensory reading in early childhood: Systematic review with theoretical guidance for human development studies. *Human Development*, *67*(4), 193–210.

Latifah, I., Suriansyah, A., & Amelia, R. (2025). Playing as a bridge to early childhood literacy: a literature review of best practices in early childhood education. *International Journal of Research in Education*, *5*(2), 343–357.

Li, S., Tang, Y., & Zheng, Y. (2023). How the home learning environment contributes to children's social–emotional competence: A moderated mediation model. *Frontiers in Psychology*, *14*, 1065978.

Li, Y., Chen, D., & Deng, X. (2024). The impact of digital educational games on student's motivation for learning: The mediating effect of learning engagement and the moderating effect of the digital environment. *PloS One*, *19*(1), e0294350.

Liu, R., Luo, F., & Israel, M. (2023). Technology-integrated computing education in early childhood: A systematic literature review. *Journal of Educational Computing Research*, *61*(6), 1275–1311.

Lo, H.-C., & Wang, T.-H. (2024). A study on the design of embedded visual image teaching aids to assist young children's cognitive and fine motor development. *Journal of Intelligence*, *12*(10), 102.

Lukum, A., Paramata, N. R., Achmad, N., & Djafar, N. (2024). *Kebijakan pendidikan, relevansinya dengan pandangan ki hajar dewantoro*. Uwais Inspirasi Indonesia.

Malone, T. W., & Lepper, M. R. (2021). Making learning fun: A taxonomy of intrinsic motivations for learning. In *Aptitude, learning, and instruction* (pp. 223–254). Routledge.

Martino, E. M., & Lape, J. E. (2021). Occupational therapy in the preschool classroom-Promoting fine motor and visual motor skills for kindergarten readiness. *Journal of Occupational Therapy, Schools, & Early Intervention*, *14*(2), 134–152.

Mawaddah, M. (2024). Literasi membaca dan menulis serta pembelajarannya pada anak usia dini. *Damhil Education Journal*, *4*(1), 15–21.

McGowan, A. L., Chandler, M. C., & Gerde, H. K. (2024). Infusing physical activity into early childhood classrooms: Guidance for best practices. *Early Childhood Education Journal*, *52*(8), 2021–2038.

Mitry, M. M. (2021). Translating constructivism into pedagogy from philosophy to practice: Active project-based learning. *The International Journal of Humanities Education*, *19*(1), 39.

Mubarroroh, A., Arafik, M., Wahyuni, S., & Arifin, I. (2023). *Pengembangan Media Pembelajaran Fun and Happy Fonetik untuk Menstimulasi Keaksaraan Awal Anak Usia 4-5 Tahun*.

Mudlofir, H. A. (2021). *Desain Pembelajaran Inovatif: dari Teori ke Praktik-Rajawali Pers*. PT. RajaGrafindo Persada.

Operto, F. F., Viggiano, A., Perfetto, A., Citro, G., Olivieri, M., Simone, V. de, Bonuccelli, A., Orsini, A., Aiello, S., & Coppola, G. (2023). Digital devices use and fine motor skills in children between 3–6 years. *Children*, *10*(6), 960.

Parker, R., Thomsen, B. S., & Berry, A. (2022). Learning through play at school–A framework for policy and practice. *Frontiers in Education*, *7*, 751801.

Patriasih, R., Yogawati, N. D., Prayogi, A., Sukmawati, W. S., Walid, A., Febriani, L., Asmara, A., Nefianthi, R., Putra, E. S., & Cahyono, D. (2025). *Membangun pendidikan berkualitas: Dari pedagogi hingga teknologi*. PT. Nawala Gama Education.

Polsley, S., Powell, L., Kim, H.-H., Thomas, X., Liew, J., & Hammond, T. (2022). Detecting children's fine motor skill development using machine learning. *International Journal of Artificial Intelligence in Education*, *32*(4), 991–1024.

Rachmadtullah, R., Setiawan, B., Wasesa, A. J. A., & Wicaksono, J. W. (2023). Elementary school teachers' perceptions of the potential of metaverse technology as a transformation of interactive learning media in Indonesia. *International Journal of Innovative Research and Scientific Studies*, *6*(1), 128–136.

Rand, M. K., & Morrow, L. M. (2021). The contribution of play experiences in early literacy: Expanding the science of reading. *Reading Research Quarterly*, *56*, S239–S248.

Sandy, A. I., Samawi, A., & Anisa, N. (2022). Pengembangan Aplikasi Game Teka-Teki Guest The Alpha Untuk Mengenalkan Alfabet Pada Anak Usia 5–6 Tahun. *Jurnal Penelitian Dan Pengembangan Pendidikan Anak Usia Dini*, *9*(1), 11–20.

Saracho, O. N. (2023). Theories of child development and their impact on early childhood education and care. *Early Childhood Education Journal*, *51*(1), 15–30.

Simatupang, J. K. N., & Bui, T. C. (2025). Motivasi dan Emosional Berperan Penting dalam Pembelajaran Pendidikan bagi Peserta Didik. *Jurnal Teologi Wesley*, *2*(1).

Slamet, F. A. (2022). Model Penelitian Pengembangan (R n D). *Malang: Institut Agama Islam Sunan Kalojogo Malang*.

Utamimah, S., Samawi, A., Arifin, I., Pramono, P., Aisyah, E. N., & Pratiwi, A. P. (2024). *Pemanfaatan Media Loose Part dalam Pembelajaran Literasi dan Sosial Emosional Anak Usia Dini. Murhum: Jurnal Pendidikan Anak Usia Dini, 5 (1), 702-711*.

Wahyuni, S. (2020). Digital literacy for children based on steam in family education. *Journal of Physics: Conference Series*, 1–7.

Yousef, A. M. F. (2021). Augmented reality assisted learning achievement, motivation, and creativity for children of low-grade in primary school. *Journal of Computer Assisted Learning*, *37*(4), 966–977.

Zheng, Y., Zhang, J., Li, Y., Wu, X., Ding, R., Luo, X., Liu, P., & Huang, J. (2024). Effects of digital game-based learning on students' digital etiquette literacy, learning motivations, and engagement. *Heliyon*, *10*(1).

Zulkarnain, N. F. (2024). *Pengembangan Media Pembelajaran Berbasis Game Teka Teki Digital Untuk Meningkatkan Kecerdasan Linguistik Pada Anak Usia Dini*. UIN Fatmawati Sukarno Bengkulu.