



Early Childhood Education Learning Design with a Deep Learning Approach: Towards Meaningful and Holistic Learning

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Abstrak

Deep Learning Policy (Deep Learning) launched by the Ministry of Education and Culture (2025) demands a reformulation of pedagogical practices at the PAUD level, but its implementation framework for early childhood has not been systematically studied. This study aims to synthesize how the principles of mindful, meaningful, and joyful learning can be translated into a concrete learning model for children aged 4-6 years. The study uses a concrete learning approach, systematic literature review with the PRISMA selection process and thematic analysis of the Miles and Huberman model. Of the 278 initial records, 20 sources met the inclusion criteria, consisting of 16 empirical articles analyzed thematically and 4 theoretical/policy references that served as conceptual foundations. Thematic analysis showed that in-depth learning practices in early childhood education are characterized by exploration, inquiry, simple projects, thematic learning, and reflection that facilitate the connection of concepts and the transfer of experiences to real contexts. Based on these findings, the study developed the 3E Model (Explore Engage Extend) as an operational pedagogical framework, not a new curriculum, that outlines these three principles into concrete, flexible, and developmentally appropriate learning stages. This model, equipped with a RPPH blueprint, authentic observation rubric, and recommendations for teacher professional development, can serve as a practical reference for PAUD educators in operationalizing in-depth learning policies at the classroom level.

INTRODUCTION

Early childhood education is an important foundation for holistic human development. In the golden age (golden age), all aspects of cognitive, motor, language, social-emotional, and spiritual development experience significant acceleration.

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Therefore, educational stimulation at this stage must be designed in a planned, systematic, and developmentally appropriate manner to ensure optimal development of a child's potential.

At this level, a learning approach is needed that not only conveys basic information but also builds deep conceptual understanding. One relevant approach is in-depth learning (deep learning), which emphasizes the development of early critical thinking skills, reflective thinking, and the ability to connect learning experiences with real-life contexts (Lukmanulhakim et al., 2025).

However, current early childhood education practices still face several fundamental issues. Many institutions still focus on academic activities and memorization, leaving children with limited opportunities for active and meaningful learning. This situation has the potential to result in surface learning that does not support the holistic development of children and is contrary to the principles of Developmentally Appropriate Practice (DAP), which emphasizes that early childhood learning must be based on direct experience, play, exploration, and active participation (NAEYC, 2020). Furthermore, active and meaningful learning methods are rarely implemented consistently in the field (Taarape, 2025), while challenges in educator capacity, limited resources, and minimal family support exacerbate the situation (Palmin & Latif, 2025).

In the context of national policy, the Ministry of Education and Culture has established in-depth learning as the direction of educational transformation through the Academic Paper on In-depth Learning (2025), which emphasizes three main principles: awareness (mindful), meaning (meaningful), and happy (joyful). These three principles naturally align with the characteristics of early childhood education (PAUD), which emphasizes hands-on experience, exploration, and holistic development. However, to date, there is no implementation model that operationally translates these three principles into everyday learning practices in PAUD units. This conceptual and practical gap forms the basis for this research.

Deep learning In the context of education, it does not refer to artificial intelligence technology, but rather to a learning strategy that emphasizes creativity, early critical thinking, reflection, and the ability to connect new experiences with existing knowledge (Rahman & Cahyawati, 2025). This approach aligns with Piaget's and Vygotsky's constructivist theories, which view children as active learners, and Ausubel's theory of meaningful learning, which emphasizes the integration of new knowledge with existing cognitive schemas. Deep learning also supports the goals of the Independent Curriculum which emphasizes learning autonomy, contextual relevance, and character development (Kharisma et al., 2025).

Based on this description, this study aims to examine how the theoretical foundations of deep learning can be adapted to the context of early childhood education (PAUD) and what strategies are effective in implementing them in early childhood. Furthermore, this study formulates an implementation model that can bridge the gap between the conceptual framework and field practice of PAUD in Indonesia.

METHOD

This study uses a design of systematic literature review with an interpretive qualitative approach to map the concepts, implementation, and challenges of in-depth learning in the context of PAUD. The reporting process follows the PRISMA standard (Preferred Reporting Items for Systematic Reviews and Meta Analyses) to ensure transparency and replicability. The literature search was conducted on three databases: Google Scholar, ERIC, and the official portal of the Ministry of Education and Culture, with publications spanning 2018-2025. Policy reference point The Ministry of Education and Culture's Deep Learning (Kemendikdasmen, 2025) was

used to ensure alignment of findings with national policy. The Boolean search string used was:

*("deep learning" AND "early childhood") OR ("deep learning" AND PAUD)
OR ("project-based learning" AND preschool) OR ("meaningful learning"
AND "anak usia dini")*

Additional searches were conducted through backward citation from selected articles to ensure completeness of literature coverage.

Inclusion criteria included: (a) articles discussing pedagogical deep learning or meaningful learning at the early childhood education (PAUD) to early elementary school levels; (b) published between 2018-2025 in Indonesian or English; (c) full text available; and (d) discussing at least one of the principles of mindful-meaningful-joyful learning or dimensions of the 6C framework. Exclusion criteria included: articles discussing deep learning in the context of artificial intelligence technology (not pedagogical), articles outside the year range, duplicates, and non-scientific sources that could not be verified.

Tabel 1. Alur Seleksi Literatur Berdasarkan Kerangka PRISMA

PRISMA Phase	Information	Number of Articles
Identification	Initial searches on Google Scholar, ERIC, and the Ministry of Education and Culture portal used the Boolean search string: ("deep learning" AND "early childhood") OR ("deep learning" AND PAUD) OR ("project-based learning" AND preschool)	247 recordings
Identification	Additional search from the reference list of selected articles (backward citation)	31 recordings
Screening	Total records before duplicate filtering	278 recordings
Screening	Recording removed due to duplication	38 records deleted
Screening	Records are filtered by title and abstract.	240 recordings filtered
Screening	Recordings were excluded due to irrelevance (topic not appropriate, level not PAUD/early elementary school, language other than Indonesian/English)	185 records released
Eligibility	Full text articles can be accessed and studied in more depth	55 articles reviewed
Eligibility	Articles were excluded because: they did not address pedagogical deep learning (n=12), no full text available (n=8), they did not address the mindful-meaningful-joyful or 6C principles (n=15)	35 articles issued
Inclusion	Sources meeting all inclusion criteria: 16 empirical articles synthesized thematically in Table 2; 4 theoretical/policy sources (Fullan, Quinn, & McEachen, 2018; Ausubel, 1968; NAEYC, 2020; Kemendikdasmen, 2025) elaborated narratively in the Literature Review	20 articles included

All sources that met the inclusion criteria (n=20) were analyzed using the Miles and Huberman framework, which includes three stages: (1) data reduction, through open coding to identify units of meaning in each literature; (2) data presentation, through thematic coding to develop thematic categories that reflect conceptual and implementative patterns; and (3) conclusion drawing, through inter-source triangulation and peer debriefing to ensure interpretive integrity. A literature synthesis table is presented as an instrument of analytical transparency. It should be emphasized that of the 20 sources, 16 are empirical research articles/reports that are the objects of the thematic synthesis (presented in Table 2), while the other 4 sources Fullan, (Fullan et al., 2018), (Ausubel, 1968), (N.A.E.Y.C., 2020), dan (Kemendikdasmen, 2025) are theoretical and policy references that also meet the inclusion criteria but serve as conceptual foundations, and therefore have been elaborated narratively in the Literature Review section rather than included in the empirical synthesis table.

RESULTS AND DISCUSSION

A. Literature Synthesis

Sixteen empirical articles that met the inclusion criteria are synthesized in Table 2. Four other theoretical and policy sources that also met the inclusion criteria Fullan, (Fullan et al., 2018), (Ausubel, 1968), (N.A.E.Y.C., 2020), dan (Kemendikdasmen, 2025)- have been narratively elaborated in the Literature Review and are not included in this table because they are conceptual in nature, not empirical findings from the field. This table presents the authors, study types, key findings, and their relevance to the 3E Model developed in this study.

Tabel 2. Empirical Literature Synthesis: Research Findings and Relevance to the 3E Model (n=16)

No.	Penulis/ Tahun	Metode/Jenis Studi	Temuan Utama	Relevansi dengan Model 3E
1.	Sari & Hakim (2023)	Quasi-experiment	PjBL in children aged 5-6 years increases collaboration and communication when projects are based on real-life contexts.	Supporting the Engage stage through meaningful mini-projects
2.	Suryani & Munandar (2022)	Action research	Integrative thematic learning develops early critical thinking through open-ended trigger questions.	Relevant for teacher strategies at the Explore and Engage levels
3.	Harris & Frazer (2021)	Longitudinal studies	Inquiry-based learning in preschool improves understanding of cause and effect through simple experiments.	Supporting the Explore stage as a foundation for mindful learning
4.	McCormick, Wong & Allen (2020)	Mixed methods	Long-term thematic projects strengthen social-emotional competencies: collaboration and empathy.	Supports the integration of 6C dimensions (collaboration, communication) in the Engage Extend stage

No.	Penulis/ Tahun	Metode/Jenis Studi	Temuan Utama	Relevansi dengan Model 3E
5.	Rasmani et al. (2022)	Descriptive survey	Teachers' understanding of exploratory activities remains minimal; meaningful learning is not yet optimal in many early childhood education units.	Confirming the implementation gaps addressed by the 3E Model
6.	Palmin & Latif (2025)	Case study	Implementation constraints include limited facilities, administrative burden, and lack of teacher training on deep learning.	Strengthening the urgency of a simple and practical implementation framework
7.	Putri & Efastri (2025)	Experiment	The integration of loose parts in PjBL significantly increases children's creativity, collaboration, and exploration.	Providing empirical evidence of the Engage stage in the context of Indonesian PAUD
8.	Afriani et al. (2025)	Action research	PjBL improves problem solving in children aged 5-6 years through local context-based projects.	Supports the Engage stage; demonstrates the adaptability of the model to local PAUD settings.
9.	Sukiman et al. (2025)	Training-evaluation	Curiosity-based project, experiment, and inquiry strategies effectively promote deep understanding.	Supports the overall three-stage design of Model 3E
10.	Wirahno dkk. (2025)	Curriculum comparison	Nature-based thematic-integrative curriculum is more effective in developing critical thinking than conventional curriculum.	Supporting the thematic approach in the Explore-Engage stage
11.	Suryana & Sari (2024)	Case study	Deep learning allows children to actively interact with the material through exploration and documentation.	Strengthening the Extend level through documentation as meaningful reflection
12.	Yuliana & Fauzia (2024)	Experiment	Play-based STEM has been proven to be effective in encouraging children to ask questions, try, compare, and reflect	Provides empirical evidence of the integration of the three stages of Explore-Engage-Extend in one activity.

No.	Penulis/ Tahun	Metode/Jenis Studi	Temuan Utama	Relevansi dengan Model 3E
on the results.				
13.	Faizin et al. (2025)	Correlational survey	Principal leadership contributes 60.7% to teacher professionalism in adopting the new curriculum.	Strengthening managerial support recommendations for the implementation of the 3E Model
14	Jayawardana (2025)	Literature review	Implementing deep learning in PAUD requires a concrete, play-based approach and active scaffolding.	Strengthening the suitability of the 3E Model stages with the developmental characteristics of PAUD
15.	Dwijantie (2025)	Qualitative descriptive	The deep learning approach in PAUD creates a conscious, meaningful, and enjoyable learning process.	Empirical confirmation of the three principles operationalized in the 3E Model
16.	Nggalu Bali et al. (2025)	Community service	Deep learning workshops in early childhood education demonstrate increased integration of principles and teacher learning experiences.	Supporting the recommendations of teacher professional development programs in this study

The synthesis of findings reveals a consistent pattern: experiential learning, projects, and guided exploration consistently produce deeper engagement and more lasting understanding in young children than conventional approaches based on memorization and direct instruction. This pattern is found in both Indonesian and international research, demonstrating the universality of the principles underlying deep learning.

B. 3E Synthesis Model: Pedagogical Implementation Framework

1. Rationale and Position of the Model

Based on the synthesis of deep learning theory, empirical findings, and national policy directions, this study develops the 3E Synthesis Model (Explore Engage Extend) as a framework for implementing in-depth learning pedagogical in PAUD. It should be emphasized from the outset that the 3E Model is not a new curriculum and is not intended to replace or modify the principles of mindful-meaningful-joyful learning which has been stipulated in the Academic (Kemendikdasmen, 2025). On the other hand, the 3E Model is a vehicle for operationalization (vehicle) an implementation framework that translates these three principles into concrete, sequential learning stages that can be adapted by PAUD teachers in the field. This difference in position is crucial: if mindful-meaningful-joyful is "What" what is to be achieved (learning orientation and character), then the 3E Model is "How" achieve this through a structured yet flexible sequence of experiences. This model fills the gap between an abstract conceptual framework and the practical needs of early childhood education teachers

who require developmentally appropriate, step-by-step guidance for children aged 4-6 years.

2. 3E Model Stages

The three stages of the 3E Model and their operationalization are presented in Table 3.

Table 3. Operationalization of the 3E Synthesis Model in Early Childhood Education Learning

Level	Deep Learning Principles	Children's Activities	The Role of Teachers	Dimension 6C
Explore	Mindful Learning	Observing, touching, smelling, hearing, asking spontaneous questions about surrounding phenomena	Provide a stimulus-rich environment; ask open-ended, stimulating questions; refrain from giving direct answers.	Character, Critical Thinking (awal)
Engage	Meaningful Learning	Doing mini-projects, role-playing, collaborating, connecting experiences with prior knowledge	Facilitate simple, context-based projects; provide scaffolding appropriate to the ZPD; encourage discussions between children	Collaboration, Communication, Creativity
Extend	Joyful Learning	Retelling experiences, creating visual works, documenting results, celebrating the learning process	Leading simple reflections; documenting children's work; celebrating the process, not just the results.	Citizenship, Communication, Character

First stage, Explore, is the entry point into the learning cycle. At this stage, children are encouraged to truly focus and actively use their five senses when observing the learning environment in line with the principles of mindful learning. In the Ministry of Education and Culture's In-Depth Learning Academic (Kemendikdasmen, 2025), teachers play a role in providing a stimulating environment, such as concrete objects, images, or situations that stimulate curiosity, and then asking open-ended questions without providing immediate answers. This approach aligns with Piaget's constructivist theory, which emphasizes that children construct their own understanding through active exploration, rather than simply receiving information from teachers.

Second stage, Engage, directing children's spirit of exploration into active involvement in meaningful activities reflecting the principles of meaningful learning. At this stage, children process the experiences they have gained through activities with friends, role-playing, or simple thematic projects, such as building a miniature of their surroundings in groups. Children begin to connect experiences, concepts, and their social lives. This process aligns with Vygotsky's theory, which states that social interaction in the Zone of Proximal Development (ZPD) with the help of guidance (scaffolding) from teachers encourages children to understand things more deeply.

The third level, Extend, functions as a space for meaning and celebration of learning—creating principles of joyful learning. Children re-express their learning experiences through retellings, visual works, documentation, or developmentally appropriate reflective conversations. This process is not intended to evaluate academic outcomes, but rather to help children recognize what they have learned and celebrate the process in a positive and enjoyable way.

3. Model Advantages and Flexibility

The primary advantage of the 3E Model lies in its ability to integrate the 6C framework into early childhood education practices without burdening children with developmentally inappropriate cognitive demands. Values such as character, collaboration, communication, creativity, and critical thinking are developed implicitly through play experiences, social interactions, and simple reflection—not through direct instruction or academic assignments.

The 3E model also has high flexibility: it does not replace existing approaches (PjBL, thematic learning, stimulated free play), but rather serves as an organizing framework which organizes learning experiences cohesively. Teachers can adapt the Explore-Engage-Extend stages into various themes, play activities, and projects according to the context of their respective PAUD units, in line with the principle of teacher autonomy in the Independent Curriculum.

C. Empirical Support for the 3E Model

Empirical research in the last five years provides strong support for experience-based and project-based approaches to developing skills in early childhood. (Afriani, 2025) found that integration of loose parts in PjBL significantly increases children's creativity, collaboration, and exploration—supporting the Engage stage in the 3E model. Afriani et al. (2025) showed that PjBL increases children's abilities in problem solving in children aged 5-6 years through local context-based activities, proving that early childhood is capable of early forms of critical thinking when the environment provides guided exploration.

Similarly, (McCormick et al., 2020) found that children's involvement in long-term thematic projects strengthened their communication, collaboration, and role-playing skills in group settings—consistent with the collaboration and communication dimensions of the 6C framework. (Suryana & Sari, 2024) findings reinforce the importance of documentation as part of the Extend stage, where the process of reflection through documentation yields deeper and more enduring understanding.

D. Implementation Support Tools

1. RPPH Blueprint Based on the 3E Model

To strengthen the applicability aspect, this study presents a RPPH blueprint based on the 3E Model as a technical guide for PAUD educators in Table 4.

Table 4. RPPH Blueprint Based on the 3E Model

RPPH components	Description	Example (Theme: Water)	Level 3E
Learning objectives	Formulated based on experience and process, not academic products	Children are able to observe the properties of water through direct exploration and share their findings.	Explore → Extend
Opening Activities	A provocative question, sensory stimulation, or surprising phenomenon	The teacher brought a bowl of ice cubes: 'What do you think this is? What do you feel?'	Explore
Core activities	Mini-projects or meaningful activities based on real contexts	Children pour water into various containers, observe changes in shape, and draw the results.	Engage
Closing Activities	Simple reflection, retelling, or documentation of work	Each child tells one interesting thing they discovered about water today.	Extend
Assessment	Authentic process-based observation, not written tests	Observation rubric: curiosity, involvement, storytelling ability, collaboration	The whole level

2. Authentic Assessment Rubric

Assessment in immersive learning cannot use conventional test instruments. The following authentic observation rubric is designed to observe children's learning across all stages of the 3E Model.

Table 5. Authentic Assessment Rubric Based on the 3E Model

Observation Aspect	Not Yet Developed (1)	Starting to Grow (2)	Developing as Expected (3)	Developing Very Well (4)
Curiosity (Explore)	Shows no interest in exploration activities	Shows interest but is passive; waits for teacher's direction	Actively observe and ask at least one spontaneous question	Asking follow-up questions and exploring independently without being prompted
Active Engagement (Engage)	Not involved in project activities or group activities	Involved occasionally when asked; does not take initiative	Consistently involved; contributing to the group; following the flow of activities	Leading initiatives in groups; developing ideas beyond teacher instructions
Collaboration (Engage)	Not wanting to interact or	Interacts but tends to	Sharing materials,	Helping friends in trouble

Observation Aspect	Not Yet Developed (1)	Starting to Grow (2)	Developing as Expected (3)	Developing Very Well (4)
	share with friends	dominate or withdraw	taking turns, and listening well to friends	spontaneously; showing active empathy
Reflection & Expression (Extend)	Unwilling or unable to tell about his experiences	Tell a story briefly with the help of questions from the teacher	Telling experiences in complete sentences; mentioning what was learned	Connecting today's experiences with previous experiences; giving personal meaning
Creativity (Extend)	Not producing work or just copying exactly what a friend has	Produces work with a lot of help; lacks originality	Produce work that reflects personal interpretation	Producing unique work and being able to explain the meaning behind the work

3. Teacher Professional Development Recommendations

Literature findings consistently indicate that teacher capacity is the most crucial variable in the successful implementation of immersive learning. Based on this, research recommends professional development programs that include: a. Practice-based training (practice-based professional development) which uses the Explore Engage Extend cycle directly, so that teachers experience in-depth learning themselves before implementing it b. A professional learning community (KBP) among PAUD teachers that facilitates sharing of practices, joint reflection, and collaborative problem-solving of implementation. c. School-based mentoring by mentors or principals who understand the principles of deep learning, considering the significant contribution of principal leadership (60.7%) to the adoption of the new curriculum (Faizin et al., 2025). d. Utilizing children's digital portfolios as a medium for teacher reflection, where documentation of children's work becomes data for analyzing the effectiveness of learning stages.

These four strategies complement each other: training and learning communities build teachers' initial competencies, principal mentoring ensures the sustainability of implementation, while digital portfolios provide reflective data for teachers to continually adjust their classroom practices.

CONCLUSION

This study shows that deep learning (deep learning) is relevant to be applied to PAUD as long as it is adapted to the characteristics of child development. A synthesis of 16 empirical articles and 4 theoretical-policy references shows that the principlemindful, meaningful, And joyful learningin line with how children learn through play, exploration, and concrete experiences, although there is still a gap between the conceptual framework and the absence of an applicable implementation model for teachers.

Responding to this gap, the research developed the 3E Model (Explore-Engage-Extend) as a pedagogical implementation framework, not a new curriculum, which translates the principles of the Ministry (Kemendikdasmen, 2025) policy into concrete stages: Explore formindful learning, Engage formeaningful learning, and Extend forjoyful learningThis model is equipped with a RPPH blueprint, authentic

assessment rubric, and recommendations for teacher professional development.

Theoretically, this research expands the discourse on deep learning. In the rarely studied realm of early childhood education (PAUD), the 3E Model helps teachers integrate in-depth learning into daily activities, in line with the direction of the Independent Curriculum. This model can serve as an initial framework for teachers in designing process-oriented learning, a reference for curriculum developers in developing RPPH and authentic assessments, and opens up opportunities for future researchers to empirically test its effectiveness and develop standardized assessment instruments for the Indonesian PAUD context.

DAFTAR PUSTAKA

- Abdullah, A., & Yahya, S. (2025). Study of the use of deep learning in learning at training institutions. *PROD: Journal of Learning Studies and Educational Administration*, 2(1), 25-41.
- Afriani, et al. (2025). Project-based learning and problem-solving skills of 5-6 year old children: A local context-based study. *Indonesian Early Childhood Education Journal*, 12(1), 45-58.
- Asmi, Y. K., Wibawa, S., Barriyah, I. Q., Nisa, A. F., & Zulfiati, H. M. (2025). Development of PjBL and deep learning to improve student creativity in Pancasila integrated arts education. *Socioeducation: Scientific Journal of Educational and Social Sciences*, 14(2), 832-846.
- Ausubel, D. P. (1968). *The psychology of meaningful verbal learning: An introduction to school learning*. Grune & Stratton.
- Dwijantie, J. S. (2025). Deep learning approach in learning to build deep understanding for early childhood PAUD. *Journal of Early Childhood Education*, 4(3), 1238-1246.
- Faizin, Egar, N., & Wuryandini, E. (2025). Teacher professionalism and its challenges in the era of deep learning curriculum. *Edunomika*, 9(2), 1-13.
- Fullan, M., Quinn, J., & McEachen, J. (2018). *Deep learning: Engage the world, change the world*. Corwin Press.
- Harris, L., & Frazer, C. (2021). Inquiry learning in early childhood classrooms: Developing causal reasoning through play. *Early Childhood Research Quarterly*, 56, 245-258. <https://doi.org/10.1016/j.ecresq.2021.03.005>
- Hidayat, A. G., & Haryati, T. (2025). Analysis of learning effectiveness using a deep learning approach in elementary schools. *Curriculum: Journal of Education*, 9(2), 126-139.
- Jayawardana, H. B. A. (2025). Implementation of deep learning in early childhood education (PAUD). *JECIE (Journal of Early Childhood and Inclusive Education)*, 8(2), 510-516. <https://doi.org/10.31537/jecie.v8i2.2476>
- Ministry of Education and Culture. (2022). *Early Childhood Education Learning Guidelines*. Ministry of Education, Culture, Research, and Technology of the Republic of Indonesia.
- Ministry of Elementary and Secondary Education. (2025). *Academic paper on in-depth learning: Towards quality education for all*. Ministry of Elementary and Secondary Education of the Republic of Indonesia.
- Kharisma, N., Septiani, D. E., & Suryaningsih, F. (2025). Transforming meaningful learning through deep learning: A literature review within the framework of the Independent Curriculum. *Journal of Educational Innovation*, 9(1), 45-60.

- Lukmanulhakim, L., Miranda, D., Amalia, A., Ramadhani, A., Perdina, S., & Sabila, D. K. (2025). Understanding deep learning: Basic concepts and their applications in education. *ARSY: Journal of Research Applications to Society*, 6(2), 437-442.
- McCormick, K., Wong, V., & Allen, K. (2020). Project-based learning and socio-emotional development in preschool settings. *Journal of Early Childhood Education*, 48(3), 321–338. <https://doi.org/10.1007/s10643-020-01045-9>
- Meila, V. E. F., Sarah, R. N., & Hardiana, A. (2025). Towards adaptive learning in early childhood education: Challenges of implementing deep learning in the Indonesian context. *Tunas Cendekia: Journal of Early Childhood Education Study Program*, 8(2), 93-101. <https://doi.org/10.24256/tunascendekia.v8i2.7258>.
- NAEYC. (2020). Developmentally appropriate practice: A position statement of the National Association for the Education of Young Children. National Association for the Education of Young Children.
- Nggalu Bali, E., Windiarti, R., Kristanto, W., Redy, P., Jaya, P., & Dima, R. K. (2025). Deep learning approach workshop in PAUD: Integration of principles, learning experiences, and learning frameworks. *Abdimas Pedagogi: Scientific Journal of Community Service*, 8(2), 172–179.
- Palmin, B., & Latif, S. A. (2025). Efforts and challenges in implementing the Independent Curriculum in non-formal PAUD. *Murhum PAUD Journal*, 6(1), 55-67. <https://doi.org/10.37985/murhum.v6i1.864>
- Putri, & Efastri. (2025). Integration of loose parts in project-based learning to enhance early childhood creativity. *Journal of Early Childhood Education*, 9(1), 12–25.
- Rahman, A., & Cahyawati, D. (2025). Optimizing the implementation of deep learning-based learning in PAUD. *PAUD Agapedia Journal*, 9(1), 69-76.
- Rasmani, U. E. E., Fitrianingtyas, A., Zuhro, N. S., & Nazidah, M. D. P. (2022). Integrative holistic for early childhood education. *Jurnal Kumara Cendekia*, 10(3), 226-231.
- Sari, T., & Hakim, R. (2023). Project-based learning in early childhood education: Enhancing collaboration and communication. *Journal of Early Years Learning*, 12(1), 45–56.
- Sukiman, Rahayu, A., Hariani, B., Sarini, Mulyati, S., & Hajrah, S. (2025). Implementation of the deep learning model for non-formal PAUD educators in Tuah Madani District, Pekanbaru City. *Pelita Community Service Journal*, 2(2), 19-34.
- Suryana, D., & Sari, A. M. (2024). Application of deep learning in meaningful learning, through fun learning practices in kindergarden. *The International Journal of Early Childhood Learning*, 31.
- Suryani, D., & Munandar, I. (2022). Thematic-integrative learning to stimulate critical thinking in early childhood. *Journal of Early Childhood Education*, 7(2), 101-114.
- Taarape, A. S. (2025). Introduction to adaptive environment-based deep learning. *Journal of Educational Technology*, 6(3), 4727-4736.
- Wirahno, D., Sari, I., & Lestari, B. (2025). Implementation of a deep learning-based curriculum to optimize early childhood involvement at PAUD Alam Jungle School Semarang. *Sentra Cendekia*, 6(2), 63-72.
- Yuliana, M., & Fauzia, N. (2024). Play-based STEM to support inquiry skills in

preschool children. International Journal of Early Childhood Education,
55(1), 89-104. <https://doi.org/10.1007/s13158-023-00345-7>

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