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

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Abstrak

Early childhood education requires an approach that fosters meaningful understanding, holistic experiences, and active child engagement. This systematic literature review, analyzed using Miles and Huberman's qualitative procedures and the PRISMA reporting framework, examines how deep learning can be designed for early childhood education (ECE) and aligned with the principles of mindful, meaningful, and joyful learning as outlined in the Ministry of Education and Culture's (Kemendikbud) Academic Paper on Deep Learning (2025). Of the 278 initial records, 20 sources met the inclusion criteria, comprising 16 thematically analyzed empirical articles and 4 theoretical/policy references that served as conceptual underpinnings. The findings indicate that deep learning in ECE emphasizes exploration, inquiry, simple projects, thematic learning, and reflection, supporting conceptual connectivity and the transfer of experiences to real-world contexts. Based on this synthesis, the study developed the 3E Model (Explore-Engage-Extend) as a pedagogical implementation framework not a new curriculum that translates the three principles of mindful, meaningful, and joyful learning into concrete, flexible, and developmentally appropriate learning stages for children aged 4-6 years. This model is equipped with a RPPH blueprint, authentic observation rubric, and teacher professional development recommendations.

INTRODUCTION

Early childhood education is a crucial foundation for holistic human development. During the golden age, all aspects of cognitive, motor, language, socio-emotional, and spiritual development experience significant acceleration. Therefore, educational stimulation at this stage must be designed in a planned, systematic, and developmentally appropriate manner to ensure optimal development of children's potential.

At this stage, a learning approach is needed that goes beyond simply conveying basic information but also fosters in-depth conceptual understanding. One relevant approach is deep learning, which emphasizes the development of early critical thinking skills and reflection, as well as the ability to connect learning experiences to real-life contexts (Lukmanulhakim et al., 2025).

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However, current early childhood education practices still face several fundamental challenges. Many institutions still focus on academic activities and memorization, thus depriving children of opportunities for active and meaningful learning. This situation has the potential to result in surface learning shallow learning that does not support a child's holistic development and contradicts the principles of Developmentally Appropriate Practice (DAP), which emphasize that early childhood learning should be based on direct experience, play, exploration, and active participation (N.A.E.Y.C., 2020). Furthermore, active and meaningful learning methods are rarely implemented consistently in the field (Taarape, 2025) while challenges related to educator capacity, limited resources, and minimal family support exacerbate the situation (Palmin & Latif, 2025).

Within the context of national policy, the Ministry of Elementary and Secondary Education has established deep learning as the direction of educational transformation in the Ministry's Deep Learning Kemendikdasmen (2025), which emphasizes three main principles: mindful, meaningful, and joyful. These three principles naturally align with the characteristics of Early Childhood Education (ECE) which emphasize direct experience, exploration, and holistic development. However, there is no implementation model that operationally translates these principles into everyday learning practices in early childhood education (PAUD) units.

Deep learning in the educational context 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).

The research questions underlying this study are: (1) How can the concepts and theoretical foundations of deep learning be adapted to the PAUD context? (2) What strategies have proven effective in implementing deep learning in early childhood? and (3) What implementation model can bridge the gap between the conceptual framework and field practice in PAUD in Indonesia? This research aims to provide a comprehensive overview and offer a practical implementation framework for early childhood education educators.

The Concept and Theoretical Foundations of Deep Learning

Deep learning, in the context of education, refers to a learning process that enables students to build conceptual understanding, develop higher-order thinking skills, and apply knowledge to new situations meaningfully. Fullan, Quinn, dan McEachen (2018) define deep learning as a learning experience that fosters 21st-century competencies through six dimensions known as the 6C framework: character, citizenship, collaboration, communication, creativity, and critical thinking. This framework emphasizes learning that goes beyond memorization by encouraging exploration, idea generation, and authentic problem solving.

The foundation of the deep learning concept is supported by Ausubel (1968) theory of meaningful learning, which emphasizes that new information must be integrated with students' existing knowledge to prevent learning from being superficial and easily forgotten. This principle is highly relevant in early childhood education because children need concrete experiences as a bridge between prior knowledge and new experiences. In line with this, Hidayat dan Haryati (2025) emphasized that the essence of deep learning is ensuring that students not only

absorb information but are able to analyze and evaluate that knowledge critically.

Furthermore, Piaget and Vygotsky's constructivist theories Strengthen the philosophical foundation of deep learning. Piaget proposed that children construct cognitive schemas through active mental and physical activity (assimilation and accommodation), while Vygotsky emphasized the importance of social interaction and scaffolding support from teachers within the zone of proximal development (ZPD). Both perspectives position children as active agents constructing meaning through exploration and interaction, thus aligning with the orientation of deep learning.

National Immersive Learning Policy and Framework

In Indonesia, immersive learning is the direction of national education transformation, as emphasized in the Ministry of Education and Culture's Kemendikdasmen (2025). Immersive Learning Academic Paper. This policy document establishes three interrelated core principles: (1) mindful learning, which encourages self-awareness and full presence in the learning process; (2) meaningful learning, which emphasizes the relevance of learning experiences to students' real lives; and (3) joyful learning, which creates a pleasant and safe learning environment. These three principles are not separate hierarchies, but rather a unified whole that reinforces each other in learning practices.

At the Early Childhood Education (PAUD) level, the immersive learning philosophy aligns with the Independent Curriculum (Kurikulum Merdeka), which emphasizes play-based learning, environmental exploration, and integration across developmental domains. This policy guides children to become autonomous learners, capable of critical thinking appropriate to their developmental stage, and possessing strong character (Kemendikdasmen, 2025). The Early Childhood Education (PAUD) learning guidelines (Kemendikbud, 2022) and the Pancasila Student Profile also reinforce the importance of character-oriented learning, reflection, and authentic experiences.

Early Childhood Education Principles and Their Alignment with Deep Learning

Early childhood education must be tailored to the child's developmental stage, individual needs, and socio-cultural context, as emphasized by Developmentally Appropriate Practice (DAP) (N.A.E.Y.C., 2020) DAP stipulates that learning takes place through play, interaction, exploration of concrete materials, and hands-on experiences that involve all aspects of development. These principles naturally align with deep learning because both encourage children's active involvement in building meaningful understanding.

Children learn most effectively when given opportunities to observe, experiment, collaborate, and build understanding through authentic experiences. Play-based learning supports the concept of joyful learning; social interaction and prompting questions from teachers support mindful and meaningful learning. Thus, deep learning does not conflict with early childhood education principles but rather strengthens the implementation of DAP in realizing holistic, developmentally appropriate learning (Jayawardana, 2025).

The main challenge lies not in conceptual compatibility, but rather in translating deep learning principles often formulated for higher levels into concrete practices for children aged 4–6. This gap formed the basis for developing the implementation model in this study (Meila et al., 2025).

Strategies and Approaches to Implementing Deep Learning in Early Childhood Education

Deep learning implementation in early childhood education can be realized through various experiential learning strategies. Project-Based Learning (PjBL) is one of the most widely used approaches because it allows children to engage in simple projects related to everyday life. Sari dan Hakim (2025) found that PjBL for children aged 5-6 years can improve collaboration and communication when projects are designed based on real-world contexts, such as gardening, setting up a mini market, or environmental activities. This finding is supported by Asmi et al. (2025) who reported that the deep learning-based PjBL model significantly improved students' creativity scores, particularly in terms of originality and flexibility of thinking.

An integrative thematic approach has also been shown to support deep learning by enabling children to understand the interconnections between concepts through relevant themes. Suryani & Munandar (2022) found that thematic learning in early childhood education (PAUD) helps children develop simple critical thinking skills through provocative questions such as "why," "how," and "what happens if...". This finding is supported by Wirahno dkk (2025) who demonstrated that thematic-integrative and nature-based curricula are more effective in developing children's creativity than conventional curricula.

Furthermore, inquiry-based learning, play-based STEM, and real-life literacy have been shown to effectively encourage children to ask questions, experiment, compare, and reflect on their observations (Yuliana & Fauzia, 2024). Essentially, deep learning in PAUD is not about providing abstract academic material, but rather about providing real-life experiences that stimulate thinking, questioning, and experimentation.

Empirical Evidence of Deep Learning in Early Childhood Education

Empirical studies on deep learning in early childhood education in Indonesia are still relatively limited compared to those at the elementary and secondary school levels. Rasmani et al (2023) noted that teachers' understanding of exploratory activity design is still minimal, resulting in suboptimal meaningful learning in many early childhood education units. Palmin dan Latif (2025) identified implementation barriers such as limited facilities, administrative burdens, and a lack of teacher training on deep learning.

International research supports the finding that exploration and project-based learning effectively develop early critical thinking. Harris dan Frazer (2021) reported that inquiry-based learning in preschools enhances understanding of cause and effect through simple experiments. McCormick, Wong, dan Allen (2020) found that long-term thematic projects can strengthen social-emotional competencies, particularly collaboration and empathy. Suryana dan Sari (2024) demonstrated that deep learning allows children to actively interact with materials through exploration and documentation, resulting in deeper understanding than conventional approaches.

Supporting and Inhibiting Factors for Implementation

The success of deep learning is influenced by a number of interacting factors. Teachers play a central role as designers of learning experiences, facilitators, and observers of child development. Faizin dkk (2025) found that principal leadership contributed 60.7% to teacher professionalism in adopting the new curriculum, while a collaborative work culture and high internal motivation (73.2%) were the driving forces behind the transition from conventional methods to deep learning.

However, implementation is not without obstacles. Limited teacher training, institutional capacity, and material resources are often major obstacles (Palmin & Latif, 2025). Conversely, a collaborative culture, partnerships with parents, and an

experiential learning environment are supporting factors consistently found in the literature. Abdullah dan Yahya (2025) emphasized that adequate infrastructure support and flexible school policies enable teachers to focus on creating mindful, meaningful, and joyful learning, significantly increasing student engagement.

Research Gaps

The literature review revealed four significant gaps that justified this research. First, empirical studies specifically examining the implementation of deep learning in Indonesian early childhood education (ECE) are still very limited, resulting in a lack of a strong understanding of best practices in the field. Second, there are no guidelines for deep learning designs tailored to the characteristics of early childhood development within the Indonesian cultural and policy context. Third, the adaptation of the 6C framework to the Indonesian ECE context lacks an adequate empirical foundation. Fourth, an implementation model that systematically integrates the principles of mindful, meaningful, and joyful learning into concrete ECE practices that are easy for teachers to adopt has not been developed. These four gaps prompted this research to develop the 3E Synthesis Model as a conceptual and practical response.

METHODS

This research used a systematic literature review design with an interpretive qualitative approach to map the concept, implementation, and challenges of deep learning in the ECE context. The reporting process followed the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) standards to ensure transparency and replicability. A literature search was conducted across three databases: Google Scholar, ERIC, and the official portal of the Ministry of Education and Culture, with publications spanning 2018-2025. The Ministry of Education and Culture's Deep Learning Academic Paper (2025) was used as a policy reference point 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 "early childhood").

An additional search was conducted through backward citations of selected articles to ensure comprehensive coverage of the literature. Inclusion criteria included: (a) articles discussing pedagogical deep learning or meaningful learning at the 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 the dimensions of the 6C framework. Exclusion criteria included: articles discussing deep learning in the context of artificial intelligence technology (not pedagogical), articles outside the specified year range, duplicates, and unverifiable non-scientific sources. The literature selection process is presented in Table 1 below.

Table 1. Literature Selection Flow Based on the PRISMA Framework

PRISMA Phase	Description	Number of Articles
Identification	Initial search on Google Scholar, ERIC, and the Ministry of Education and Culture's portal using the Boolean search string: ("deep learning" AND "early childhood") OR ("deep learning" AND PAUD) OR ("project-based learning" AND preschool)	**247 records**
Identification	Additional search of selected articles' reference lists (backward citation)	**31 records**

PRISMA Phase	Description	Number of Articles
Screening	Total records before duplicate screening	**278 records**
Screening	Records excluded due to duplicates	**38 records removed**
Screening	Records filtered based on title and abstract	**240 records screened**
Screening	Records excluded due to irrelevance (inappropriate topic, level other than PAUD/early elementary school, language other than Indonesian/English)	**185 records removed**
Eligibility	Full-text articles accessed and reviewed in more depth	**55 articles Reviewed**
Eligibility	Articles were excluded due to: not addressing pedagogical deep learning (n=12), not having full text available (n=8), not addressing the mindful-meaningful-joyful principles or the 6Cs (n=15).	**35 articles were excluded.**
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 were included.**

All sources meeting 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, Quinn, and McEachen (2018), Ausubel (1968), NAEYC (2020), and 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.

RESULT AND DISCUSSION

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, Quinn, dan McEachen (2018) Ausubel (1968); NAEYC (2020); dan Kemendikdasmen (2025) have been elaborated narratively in the Literature Review section 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 research.

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

No.	Author/Year	Method/Type of Study	Main Findings	Relevance to the 3E Model
1	Sari & Hakim (2023)	A quasi experimental	PjBL project in 5-6 year olds improves collaboration and communication when projects are based in real-life contexts.	Supports the Engage stage through meaningful mini-projects.
2	Suryani & Munandar (2022)	Action research	Integrative thematic learning develops early critical thinking through open-ended prompting questions.	Relevant to teacher strategies at the Explore and Engage stages.
3	Harris & Frazer (2021)	Longitudinal study	Inquiry-based learning in preschool improves cause and effect understanding through simple experiments.	Supports 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 the 6C dimensions (collaboration, communication) in the Engage-Extend stage.
5	Rasmani et al. (2022)	Descriptive survey	Teachers' understanding of exploratory activities is still minimal; Meaningful learning is not yet optimal in many early childhood education (PAUD) units.	Confirming the implementation gap 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.	Reinforcing the urgency of a simple and practical implementation framework.
7	Putri & Efastri (2025)	Experiment	Integrating loose parts in PjBL significantly increases children's creativity, collaboration, and exploration.	Providing empirical evidence of the Engage stage in the Indonesian PAUD context.
8	Afriani dkk. (2025)	action research	PjBL improves problem-solving in 5-6-year-old children through locally context-based projects.	Supporting the Engage stage; demonstrating the model's adaptability to local PAUD settings.
9	Sukiman dkk. (2025)	Training-evaluation	Curriculum-based projects, experiments, and inquiry strategies effectively promote deep understanding.	Supporting the overall three-stage design of the 3E Model.
10	Wirahno dkk. (2025)	Curriculum comparison	A nature-based thematic-integrative curriculum is more effective in developing critical thinking than a conventional curriculum.	Supporting a 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 stage through documentation as meaningful reflection.
12	Yuliana & Fauzia (2024)	experiments	Play-based STEM proven effective in encouraging children to ask questions, try, compare, and reflect on results.	Providing empirical evidence for the integration of the three Explore-Engage-Extend stages in one activity.
13	Faizin dkk. (2025)	Correlational survey	Principal leadership contributes 60.7% to teacher professionalism in adopting a new curriculum.	Strengthening recommendations for managerial support for the implementation of the 3E Model.

No.	Author/Year	Method/Type of Study	Main Findings	Relevance to the 3E Model
14	Jayawardana (2025)	Literature review	Implementing deep learning in early childhood education (PAUD) requires a concrete, play-based approach and active scaffolding.	Strengthening the alignment of the 3E Model stages with the developmental characteristics of PAUD.
15	Dwijantie (2025)	Descriptive-qualitative	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 dkk. (2025)	Community service	Deep learning workshops in early childhood education (PAUD) demonstrate increased integration of principles and teacher learning experiences.	This supports the recommendations for teacher professional development programs in this study.

The synthesis findings show a consistent pattern: experiential learning, project-based learning, and guided exploration consistently result in 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.

3E Synthesis Model: Pedagogical Implementation Framework

Rationale and Position of the Model

Based on the synthesis of deep learning theory, empirical findings, and national policy directions, this study developed the 3E Synthesis Model (Explore-Engage-Extend) as a pedagogical implementation framework for deep learning in early childhood education (ECE). 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 mindful-meaningful-joyful learning principles established in the Kemendikbud Academic Manuscript (2025). Rather, the 3E Model is an operationalization vehicle an implementation framework that translates these three principles into concrete, sequential learning stages that can be adapted by ECE teachers in the field.

This distinction between these positions is crucial: if mindful-meaningful-joyful is the "what" to be achieved (the orientation and character of learning), then the 3E Model is the "how" to achieve it 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 step-by-step guidance that is developmentally appropriate for children aged 4-6 years.

Stages of the 3E Model

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

Stages	Principles of Deep Learning	Children's Activities	Teacher's Role	Dimension 6C
Explore	Mindful Learning	Observing, touching, smelling, listening, and asking spontaneous questions about surrounding phenomena.	Providing a stimulating environment; asking open-ended questions; refraining from giving direct answers.	Character, Critical Thinking

Stages	Principles of Deep Learning	Children's Activities	Teacher's Role	Dimension 6C
Engage	Meaningful Learning	Conducting mini-projects, role-playing, collaborating, connecting experiences to prior knowledge.	Facilitating simple, context-based projects; providing scaffolding appropriate to the child's ZPD; encouraging discussions between children.	Collaboration, Communication, Creativity
Extend	Joyful Learning	Retelling experiences, creating visual works, documenting outcomes, celebrating the learning process.	Leading simple reflections; documenting children's work; celebrating the process, not just the outcome.	Citizenship, Communication, Character

The first stage, Explore, is the entry point into the learning cycle. At this stage, children are stimulated to be fully present cognitively and sensorially in line with the mindful learning principles outlined in the Ministry of Elementary and Secondary Education (2025). Teachers provide a stimulating environment and ask open-ended questions that spark curiosity, without immediately providing answers. This approach aligns with Piaget's constructivist theory, which emphasizes that understanding is built from within children through active exploration, not through the passive transmission of information.

The second stage, Engage, directs children's exploratory energy toward active engagement in meaningful activities reflecting the principles of meaningful learning. At this stage, acquired experiences are processed through collaborative activities, role-playing, or simple thematic projects. Children begin to build connections between their experiences, concepts, and social contexts. This process aligns with Vygotsky's theory, where social interactions within the ZPD facilitated by teacher scaffolding encourage the internalization of understanding.

The third stage, Extend, serves as a space for meaning-making and celebration of learning embodying the 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.

Strengths and Flexibility of the Model

The primary advantage of the 3E Model lies in its ability to integrate the 6C framework into early childhood education (PAUD) 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 offers significant flexibility: it does not replace existing approaches (PJBL, thematic learning, stimulated free play), but rather serves as an organizing framework that cohesively organizes learning experiences. Teachers can

adapt the Explore Engage Extend stages into various themes, play activities, and projects according to the context of their individual PAUD units, in line with the principle of educator autonomy in the Independent Curriculum.

Empirical Support for the 3E Model

Empirical research over the past five years provides strong support for experiential and project-based approaches to developing deep learning skills in early childhood. Putri dan Efastri (2025) found that the integration of loose parts in Project-Based Learning (PjBL) significantly increased children's creativity, collaboration, and exploration supporting the Engage stage in the 3E model. Afriani dkk. (2025) demonstrated that Project-Based Learning (PjBL) improved the problem-solving skills of 5-6-year-old children through locally context-based activities, demonstrating that young children are capable of early forms of critical thinking when the environment provides guided exploration.

McCormick, Wong, dan Allen (2020) found that children's involvement in long-term thematic projects strengthened their communication, collaboration, and role-playing skills in group situations consistent with the collaboration and communication dimensions of the 6C framework. Suryana dan 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.

Supporting Tools for Implementation

3E Model-Based RPPH Blueprint

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

Table 4. 3E Model-Based RPPH Blueprint

RPPH Components	Description	Example (Theme: Water)	Stage 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 Activity	Eliciting questions, sensory stimulation, or surprising phenomena.	Teacher brings a bowl of ice cubes: 'What do you think this is? What do you feel?	Explore
Core Activity	Mini-project or meaningful activity based on real context.	Children pour water into various containers, observe changes in shape, and draw the results.	Engage
Closing Activity	Simple reflection, retelling, or documentation of work.	Each child shares one interesting thing they discovered about water today.	Extend

RPPH Components	Description	Example (Theme: Water)	Stage 3E
Assessment	Authentic, process-based observation, not a written test.	Observation rubric: curiosity, engagement, storytelling, collaboration.	All stages

Authentic Assessment Rubric

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

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

Observation Aspect	Not Yet Developing (1)	Starting to Develop (2)	Developing as Expected (3)	Developing Very Well (4)
Curiosity (Explore)	Does not show interest in exploration activities.	Shows interest but is passive; waits for teacher direction.	Actively observes and asks at least one spontaneous question.	Asks follow-up questions and explores independently without being asked.
Active Involvement (Engage)	Does not participate in project or group activities.	Participates occasionally when asked; does not take initiative.	Consistently engages; contributes to the group; follows the flow of activities.	Leads initiatives in the group; develops ideas beyond teacher instructions.
Collaboration (Engage)	Does not interact or share with peers.	Interacts but tends to dominate or withdraw.	Shares materials, takes turns, and listens well to peers.	Helps peers who are struggling spontaneously; shows active empathy.
Reflection & Expression (Extend)	Does not want or is unable to share experiences.	Tells stories briefly with the help of teacher questions.	Tells experiences in complete sentences; mentionswhat was learned.	Connects today's experiences with previous experiences. giving personal meaning
Creativity (Extend)	Does not produce work or only copies exactly what a friend has produced.	Produces work with a lot of help; lacks originality.	Produces work that reflects personal interpretation.	Produces work that is unique and able to explain the meaning behind it.

Teacher Professional Development Recommendations

Literature findings consistently indicate that teacher capacity is the most crucial variable in the successful implementation of deep learning. Based on this, research recommends professional development programs that include: Practice-based

professional development using the Explore-Engage-Extend cycle, allowing teachers to directly experience deep learning before implementing it; Professional learning communities (PLCs) among early childhood education (ECE) teachers that facilitate the sharing of practices, joint reflection, and collaborative problem-solving in implementation; School-based mentoring by mentors or principals who understand deep learning principles, given the significant contribution of principal leadership (60.7%) to the adoption of new curricula (Faizin et al., 2025) and the use of children's digital portfolios as a medium for teacher reflection, where documentation of children's work serves as data for analyzing the effectiveness of learning stages.

CONCLUSION

This research demonstrates that the concept of deep learning has strong relevance for application in early childhood education, provided it is appropriately adapted to the characteristics of child development. A systematic review of 16 empirical articles complemented by four theoretical and policy references as a conceptual foundation indicates that the principles of mindful, meaningful, and joyful learning align with how early childhood learns through play, exploration, social interaction, and concrete experiences. However, there is a significant gap between the conceptual framework of deep learning and field practice in early childhood education, particularly related to the lack of a practical and contextual implementation model for teachers.

In response to this gap, this research developed the 3E Synthesis Model (Explore-Engage-Extend) as a pedagogical implementation framework not a new curriculum that translates the principles of the Ministry of Elementary and Secondary Education's (Kemendikbudsmen) national policy (2025) into concrete learning stages. This model emphasizes that Explore operationalizes mindful learning, Engage operationalizes meaningful learning, and Extend operationalizes joyful learning maintaining the integrity of the policy principles while providing a practical structure for teachers to adopt. The 3E Model is equipped with a RPPH blueprint, authentic assessment rubrics, and comprehensive professional development recommendations.

Theoretically, this research expands the discourse on deep learning from a previously limited perspective on early childhood education. Practically, the 3E Model offers an alternative learning design that helps teachers integrate deep learning principles into daily activities in early childhood classrooms, in line with the direction of the Independent Curriculum transformation and national education policy.

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