Comprehending Early Childhood Educators' Knowledge, Attitudes, Practices, and Advocacy for Deep Learning

Nur Cholimah
Early Childhood Education, Faculty of Education, Universitas Negeri Yogyakarta
Jl. Colombo No.1, Karangmalang, Caturtunggal, Kec. Depok, Kabupaten Sleman, Daerah Istimewa Yogyakarta 55281, Indonesia
E-mail address: nurcholimah@uny.ac.id
ORCID: https://orcid.org/0000-0001-9442-2201

Nurul Arifiyanti
Early Childhood Education, Faculty of Education, Universitas Negeri Yogyakarta,
Jl. Colombo No.1, Karangmalang, Caturtunggal, Kec. Depok, Kabupaten Sleman, Daerah Istimewa Yogyakarta 55281, Indonesia
E-mail address: nurularifiyanti@uny.ac.id
ORCID: https://orcid.org/0000-0001-6914-0261

Eka Sapti Cahya Ningrum
Early Childhood Education, Faculty of Education, Universitas Negeri Yogyakarta
Jl. Colombo No.1, Karangmalang, Caturtunggal, Kec. Depok, Kabupaten Sleman, Daerah Istimewa Yogyakarta 55281, Indonesia
E-mail address: eka_sapticn@uny.ac.id
ORCID: https://orcid.org/0000-0003-2137-0281

Fitriana Tjiptasari
Non Formal Education, Faculty of Education, Universitas Negeri Yogyakarta
Jl. Colombo No.1, Karangmalang, Caturtunggal, Kec. Depok, Kabupaten Sleman, Daerah Istimewa Yogyakarta 55281, Indonesia
E-mail address: fitriana@uny.ac.id
ORCID: https://orcid.org/0000-0003-0510-3677

Martha Christianti
Early Childhood Education, Faculty of Education, Universitas Negeri Yogyakarta
Jl. Colombo No.1, Karangmalang, Caturtunggal, Kec. Depok, Kabupaten Sleman,
Daerah Istimewa Yogyakarta 55281, Indonesia
E-mail address: marthachristianti@uny.ac.id
ORCID: https://orcid.org/0000-0003-3004-4787

Nur Hayati
Early Childhood Education, Faculty of Education, Universitas Negeri Yogyakarta
Jl. Colombo No.1, Karangmalang, Caturtunggal, Kec. Depok, Kabupaten Sleman,
Daerah Istimewa Yogyakarta 55281, Indonesia
E-mail address: nurhayati@uny.ac.id
ORCID: https://orcid.org/0000-0002-3634-5436

Oktaviana Maharani
Early Childhood Education, Faculty of Education, Universitas Negeri Yogyakarta
Jl. Colombo No.1, Karangmalang, Caturtunggal, Kec. Depok, Kabupaten Sleman,
Daerah Istimewa Yogyakarta 55281, Indonesia
E-mail address: oktavianamaharani@uny.ac.id
ORCID: https://orcid.org/0009-0006-1373-681X

ABSTRACT

Aim. The goal of this study was to look into how early childhood educator feel about deep learning, including their knowledge, attitudes, practices, and support for it.

Methods. This research employed a cross-sectional quantitative survey with 5,580 non-formal early childhood education instructors in Yogyakarta Province, Indonesia. We used an 18-item structured questionnaire to collect data. It asked about four areas: awareness of deep learning, attitudes and interest in implementation, deep learning–based teaching techniques, and hurdles and support for implementation.

Results. These results show that even while people have positive attitudes and are very interested, there are still practical problems. To use deep learning effectively, schools need to support it, teachers need to get professional development that is relevant to their work, and the curriculum needs to be in line with it.

Conclusions. Support from school leaders and educational institutions is crucial to close the gap between theory and practice and make sure that new ways of teaching are used successfully in early childhood education.

Keywords: deep learning, early childhood, educator's perception, early childhood educator, early childhood curriculum

Introduction

Deep learning is a pedagogical approach that emphasises children's social and emotional development, creativity, conceptual understanding, and developmentally appropriate forms of critical and reflective thinking. This method involves active intellectual engagement, including inquiry, problem solving, and guided metacognitive awareness adapted to children's developmental stages (Mystakidis, 2021). Through these processes, children construct meaning by recognising patterns and making connections between ideas in ways that are meaningful to their experiences. It is different from traditional teaching, which often tends to emphasise factual recall and surface-level understanding in certain instructional contexts (Amirova, 2025). Consequently, deep learning constitutes a conceptual framework rather than merely a technique that guides children's ongoing and comprehensive learning (Sinakou et al., 2019). In early childhood contexts, deep learning is expressed through activities such as play-based exploration, collaborative problem-solving, storytelling, and guided reflection, rather than abstract analytical reasoning.

Educational neuroscience posits that meaningful learning, which integrates new concepts with pre-existing knowledge and experiences, significantly enhances understanding, engagement, and cognitive growth (Darmanin, 2022; Darmanin & Pulis, 2023). Teachers are also important for making learning spaces that are interesting, useful, and appropriate for each student's level of development (Darling-Hammond et al., 2019; Murray, 2022). While it can be argued that elements of deep learning have long been embedded in early childhood education practices, this study does not position deep learning as an entirely new concept. Rather, it conceptualises deep learning as a structured and explicit framework that integrates cognitive, social, and emotional dimensions of learning in a more systematic way. Despite its potential to enhance meaningful and holistic learning in early childhood education, the implementation of deep learning in classroom practice remains inconsistent.

Even though early childhood education teachers often know what deep learning means in theory, many have trouble using it in their daily work. There are many reasons why there is a gap between theoretical understanding and practical implementation. These include not enough experience designing complex learning strategies, not enough resources, and the pressure to meet strict curriculum requirements (Dagnew, 2023). Teachers often find it hard to come up with complicated teaching methods, especially when it comes to making collaborative learning spaces, making tasks that are useful, and dealing with students' different skill levels (Ali et al., 2024). Insufficient infrastructure, technology, and institutional support are examples of resource constraints that make it hard for teachers to implement meaningful learning in the best way possible (Meng et al., 2023). As a result, the implementation of deep learning in classroom practice is not always effective and does not have the effect on children's development that was hoped for.

Furthermore, systemic and structural impediments affect the efficacy of deep learning implementation (Guillén-Martínez, 2025; Romero et al., 2025). High teacher–child ratios, limited facilities, lack of managerial support, and rigid educational policies can all make it harder for teachers to come up with creative ways to plan activities that promote deep learning (Akyıldız & Çelik, 2020). These challenges show that deep learning can only be successful if the education system as a whole is ready to support new teaching methods, not just if each teacher is good at their job. Studies show that to better promote creativity and deep learning, we need to focus on professional development, technology integration, and changes to the curriculum (Calavia, 2021; Freliyanti, 2025). Teachers can create more innovative and useful learning spaces for their students if they deal with these problems. These kinds of problems do not just come from technical and curricular issues; they also come from how teachers think about deep learning.

Teachers' views on deep learning are an important part of making it work (Polman, 2020). Teachers who have a positive attitude, a deep understanding of the subject, and a strong desire to teach are more likely to use interactive, reflective, and contextual teaching methods. On the other hand, teachers' creativity may be limited and their ability to change how they teach may be limited by negative perceptions or a lack of understanding. Negative perceptions associated with failure or feelings of helplessness (learned helplessness) have been demonstrated to diminish teachers' creative self-efficacy, thereby inhibiting their innovation in the development of learning activities (Anderson et al., 2021). So, it is important to know how teachers feel and think about deep learning in order to come up with good support strategies. This kind of understanding is what makes it possible to create professional learning opportunities for early childhood education teachers that are relevant and useful to them. This makes sure that the support they get is tailored to their specific needs and challenges.

It is very important for early childhood education teachers to get professional development that is relevant to their jobs and the situations they work in. To effectively implement deep learning, teachers need training, mentoring, and resources that are specific to the conditions of their classrooms. This kind of support could be in the form of workshops, mentoring programmes, practical modules, or professional learning communities that focus on how to combine theory and practice so that teachers can turn what they know into new ways to teach that help children (Maromi & Hasibuan, 2024; Novida, 2025).

Previous studies have examined deep learning in early childhood education from multiple perspectives. Some research highlights the role of neuroscience-informed approaches in supporting meaningful learning experiences, demonstrating that an understanding of brain function can help educators design activities that enhance children's comprehension and retention (De Albuquerque Rodrigues Casagrande & Guisso, 2021; Williams et al., 2025). In addition, other studies emphasise the importance of pedagogical strategies, such as the use of natural materials, multimedia resources, and play- and project-based learning, in fostering engaging and meaningful learning environments for young children (Lamrani, 2020; Ting et al., 2025).

Furthermore, a growing body of research has focused on teachers' professional competencies and internal factors that influence instructional practices. These include knowledge, attitudes, self-efficacy, and pedagogical understanding, which are closely related to the implementation of effective learning approaches (Jenßen et al., 2022; Lang et al., 2024; Salsabila et al., 2023). Professional development has also been identified as a key factor in enhancing creativity, physical literacy, and pedagogical practices among educators.

Despite these extensive studies, limited research has specifically examined how these three dimensions interact in shaping the implementation of deep learning in early childhood education, particularly in the Indonesian context. Therefore, this study provides a more integrated perspective by applying the KAP (Knowledge–Attitudes–Practices) framework to reveal not only what teachers know, but how their beliefs and contextual constraints influence their actual classroom practices. This study aims to examine early childhood educators' knowledge, attitudes, and practices related to deep learning, as well as to identify the gaps between conceptual understanding and classroom implementation.

Research Method

Research Design

This research utilised a quantitative cross-sectional survey design to investigate educators' perceptions and practices concerning deep learning in early childhood education. This design was selected because it facilitates the collection of data from a substantial number of respondents simultaneously, yielding a comprehensive overview of teachers' knowledge, attitudes, practical implementation, and contextual factors. The survey sought to collect data on four specific dimensions: (a) teachers' comprehension of deep learning concepts, (b) their attitudes and beliefs regarding its application, (c) the practical execution of deep learning-based teaching strategies, and (d) perceived obstacles and institutional support influencing its implementation. The cross-sectional method was suitable for assessing the present state of teachers' perceptions and practices, facilitating the identification of trends and areas necessitating focused professional development or institutional assistance.

Context

This study was carried out in non-formal early childhood education (ECE) settings throughout Yogyakarta province, Indonesia, to investigate teachers' perceptions of deep learning in early childhood education. The study was conducted over a duration of approx-

imately one month, during which data was gathered utilising a quantitative survey instrument disseminated through Google Forms. This method was chosen so that participants could quickly and easily access it and respond in a way that was convenient and flexible. The researcher worked with the early childhood education teachers' association in each district to make sure that data was collected fairly from all of Yogyakarta's districts. These local groups helped organise participation, spread the survey links, and get teachers to give full and accurate answers. The study concentrated on educators engaged in non-formal early childhood education programmes, encompassing play-based and community-oriented early learning environments, to obtain a comprehensive array of experiences and perceptions related to the execution of deep learning methodologies. The study utilised this sampling strategy to obtain a comprehensive overview of teacher perceptions across various contexts within the province, elucidating both overarching trends and regional disparities in understanding, attitudes, practical implementation, and perceived obstacles or facilitators for deep learning.

Participants

The quantitative study encompassed 5,580 teachers (n = 5,580) from non-formal early childhood education institutions throughout Yogyakarta Province, Indonesia (detailed participants are presented in Appendix A, see Figure A1). Total sampling was utilised to encompass all available educators affiliated with the local early childhood education teachers' associations in each district, thereby guaranteeing thorough representation of the target population. This sampling method was chosen to get the most accurate representation and cut down on sampling bias. This is because total population data gives a full picture of how teachers feel in the study context (Creswell, 1994; Taherdoost, 2016). To keep individual responses private, pseudonyms and anonymous identifiers were used.

Instruments

Two validators with expertise in early childhood education evaluated the content validity of the research questionnaire. Both experts used a 4-point Likert scale (1 = not appropriate, 2 = somewhat appropriate, 3 = appropriate, 4 = highly appropriate) to assess the suitability of each instrument component with the research objectives. The Content Validity Index (CVI) was used to determine the level of agreement between experts regarding the relevance and appropriateness of each item in measuring the intended constructs.

The questionnaire consisted of 18 items distributed across four dimensions: Understanding the Concept of Deep Learning (items 1–4), Attitudes and Interest in Ap-

plying Deep Learning (items 5–9), Deep Learning-Based Teaching Practices (items 10–14), and Barriers and Support in Implementation (items 15–18). The instrument evaluation covered aspects of content relevance, language clarity, construct representation, and item comprehensibility. The analysis showed that all instrument components received a minimum rating of 3 ("appropriate") from both validators, resulting in a CVI value of 1.00. This value exceeded the minimum acceptable threshold of 0.80, indicating excellent content validity. Nevertheless, several minor revisions were made based on expert feedback, including refinement of perception statement scoring, addition of open-ended questions related to teachers' experiences in implementing deep learning, and improvement of the questionnaire format before the instrument was administered.

To further examine construct validity, Confirmatory Factor Analysis (CFA) was conducted on the 18-item instrument across the four proposed dimensions. The CFA results showed a marginal model fit, with Comparative Fit Index (CFI) = 0.862, Tucker–Lewis Index (TLI) = 0.837, and Root Mean Square Error of Approximation (RMSEA) = 0.106. These findings indicate that the overall measurement model was moderately acceptable, although several dimensions, particularly the barriers and support dimension, may require further refinement in future studies.

Reliability analysis was subsequently conducted using Cronbach's alpha coefficients for each dimension. The results demonstrated satisfactory internal consistency for three dimensions: understanding the concept of deep learning ($\alpha = 0.809$), attitudes and interest in applying deep learning ($\alpha = 0.852$), and deep learning-based teaching practices ($\alpha = 0.802$). However, the barriers and support in implementation dimension showed lower reliability ($\alpha = 0.445$), indicating that the items within this dimension may represent relatively heterogeneous constructs. Despite this limitation, the overall reliability coefficient of the 18-item instrument was 0.903, indicating excellent internal consistency. Overall, the validity and reliability analyses demonstrated that the instrument was generally suitable for measuring teachers' understanding, attitudes, teaching practices, perceived barriers, and support needs related to deep learning implementation in early childhood education settings, although further refinement of several items is recommended to improve construct consistency in future research.

Data Collection

The data for this study was gathered over a period of one month. We sent the questionnaire out online using Google Forms so that teachers from different districts in Yogyakarta Province could easily get to it and respond quickly. This method made it easy for participants to finish the survey and made sure that the whole target population was covered.

Data Analyses

The gathered data was subjected to descriptive analysis to investigate the overarching trends in educators' perceptions and methodologies concerning deep learning in early childhood education. The analysis specifically concentrated on determining the mean and standard deviation for each item and dimension, thereby elucidating the central tendency and variability of responses. This method helped the researchers find general trends and levels of understanding, attitudes, practical use, and perceived barriers or supports among teachers in the study context.

Further, the analysis was conducted at both the dimensional and item levels for complementary purposes. Dimension-level analysis was used to identify broader tendencies related to teachers' understanding, attitudes, practices, and perceived barriers toward deep learning implementation. Meanwhile, item-level analysis was conducted to explore specific aspects within each construct that may not be fully captured through aggregated scores alone. This approach enabled a more nuanced interpretation of teachers' perceptions and practices related to deep learning in early childhood education contexts. To explore the interrelationships among questionnaire items, network analysis was conducted using JASP software with the EBICglasso estimation method. The analysis aimed to identify clustering patterns and central associations among teachers' understanding, attitudes, practices, barriers, and support related to deep learning implementation in early childhood education.

Results

According to the demographic information in Table 1, 5,587 people who worked in early childhood education took part in this study. The vast majority of participants were female, totaling 5,550 individuals (99.3%), while only 37 male respondents (0.7%) took part in the study (detailed participants are presented in Appendix B, see Table B1). This reflects global trends indicating that the early childhood education workforce is primarily female.

The biggest group of non-formal ECE institutions was play groups, which had 3,186 facilities (57%). The next biggest group was other types of institutions, which had 1,906 facilities (34.1%), and daycare centres, which had 495 facilities (8.9%). This distribution shows how different non-formal early childhood education settings are in the study area.

The educational background of respondents showed a wide range of qualifications. Most of them, 3,247 (58.1%), had completed high school. There were 1,049 respondents (18.8%) who had bachelor's degrees that were not in early childhood education (ECE), and there were 706 respondents (12.6%) who had bachelor's degrees that were in ECE. Also, 456 people (8.2%) had diplomas, 68 (1.2%) had junior high school diplomas, 48

(0.9%) had master's degrees, and only 3 (0.1%) had doctoral degrees. This educational profile indicates that although numerous early childhood education professionals possess some degree of higher education, a significant proportion still have backgrounds in secondary education.

The institutional accreditation status showed that most of the people who answered worked at accredited institutions. Of the 5,372 facilities (96.2%) that held accreditation status, only 215 (3.8%) did not. Moreover, participation in ECE training was remarkably high, with 5,156 respondents (92.3%) having attended ECE training programmes, while 431 individuals (7.7%) had never engaged in such training. These results show that the workforce is generally well-prepared in terms of institutional quality and participation in professional development, even though their formal education levels are different.

The data analysis showed that the mean score was 2.94 and the standard deviation (SD) was 0.7 (detailed participants are presented in Appendix B, see Table B2). This average value is close to the "agree" category on the 1–4 Likert scale, which means that most people who answered the question have a positive view of how deep learning is being used in early childhood education. The standard deviation of 0.65, on the other hand, shows that there is a moderate amount of response variability. This means that while most respondents tend to agree, there are still differences of opinion among educators. These results suggest that understanding, attitudes, practices, and perceptions related to barriers and support for implementing deep learning are generally positive, although variations in opinions may exist.

Understanding the Concept of Deep Learning

In the realm of comprehending the concept of deep learning, the analysis revealed that, in general, respondents predominantly aligned with the "agree" category. Of the four indicators that were measured, the one that got the highest mean score (3.11) was the one that said deep learning is a teaching method that helps children understand concepts deeply (detailed participants are presented in Appendix B, see Table B3). The one that got the lowest mean score (2.80) was the one that said children can tell the difference between deep learning and rote learning. The standard deviations across the indicators are all pretty similar, which means that the participants' answers were probably spread out in a fairly consistent way.

Attitudes and Interest in Applying Deep Learning

The analysis indicated that, regarding attitudes and interest in implementing deep learning, respondents predominantly classified themselves as "agree." Of the four indi-

cators that were measured, the one about being interested in making learning activities that make children ask questions got the highest mean score (3.11) (detailed participants are presented in Appendix B, see Table B4). Conversely, the conviction that the deep learning methodology is applicable in early childhood education attained the lowest mean score (3.04). The standard deviations, which range from 0.63 to 0.65 across the indicators, show that the responses from participants were very consistent. There was very little variation in all of the attitudes and interest in applying deep learning that were measured.

Deep Learning-Based Teaching Practices

The analysis of deep learning-based teaching practices showed that most people who answered the question tended to agree. Of the eight indicators that were measured, the one about getting children to *talk* about what they learned had the highest average score (3.04). On the other hand, the idea that deep learning is too hard to use in early childhood education got the lowest mean score (2.79) (detailed participants are presented in Appendix B, see Table B5). The standard deviations, which range from 0.55 to 0.63 across the indicators, show that the responses were evenly spread out among participants. This means that there wasn't much variation in any of the deep learning-based teaching practices that were measured.

Barriers and Support in Implementation

The analysis showed that, in terms of barriers and support for implementation, most respondents were in the "neutral to agree" group. Of the five indicators that were measured, the one about how important it is for school or institutional leaders to support innovative learning, like deep learning, got the highest mean score (3.13). The idea that the institutional curriculum does not yet support the deep learning approach, on the other hand, had the lowest mean score (2.41). The standard deviations, which range from 0.62 to 0.71 across the indicators, indicate a fairly consistent distribution of responses among participants, with moderate variability across all measured aspects of barriers and support for implementing deep learning (detailed participants are presented in Appendix B, see Table B6).

Network Analysis of Teachers' Perspectives on Deep Learning

The network analysis revealed several meaningful associations among the questionnaire items related to deep learning implementation (detailed participants are presented

in Appendix A, see Figure A2). Strong positive connections were identified among items associated with teachers' interest in encouraging questioning and critical thinking in children, indicating that inquiry-oriented attitudes tend to co-occur. In particular, the items related to encouraging children to ask questions and think critically demonstrated one of the strongest associations within the network.

In addition, several teaching practice items formed closely connected clusters, suggesting that reflective and exploratory teaching approaches are interconnected in teachers' classroom practices. Support- and barrier-related items also demonstrated moderate interrelationships, indicating that institutional support, training needs, and curriculum readiness are associated factors in the implementation of deep learning. The analysis further showed that teachers' belief in the applicability of deep learning in early childhood education occupied a relatively central position within the network, suggesting that this belief may play an important role in connecting teachers' understanding, attitudes, and instructional practices.

Discussion

In general, people who answered the survey had a positive view of how deep learning was used in early childhood education. The responses were mostly in the "agree" and "strongly agree" categories, which shows that people strongly agree with the idea that deep learning can be used in early childhood education. These findings suggest that educators consider this approach viable and pertinent in the realm of early education. Other research has shown that deep learning in early childhood education is very important because it focuses on a deep, reflective, and problem-solving-oriented learning process instead of just the results. This method helps children learn how to think critically, use what they know, and build their own understanding (Ding & Li, 2024). The discussion section will go into great detail about the four ways that teachers see deep learning in early childhood education.

The data analysis shows that teachers generally have a good understanding of deep learning, since most of them fall into the "agree" category. The highest mean score on the indicator "deep learning encourages children to understand concepts in depth" shows that teachers know how important it is for children to understand concepts and think critically from a young age. This finding is consistent with Sung-mi Park (2021), who highlighted that deep learning prioritises meaningful comprehension over rote memorisation, and that educators cognisant of this principle are more equipped to facilitate significant learning experiences.

On the other hand, the lowest score on the ability to tell the difference between deep learning and rote learning shows how hard it is for teachers to understand the concepts. Previous research has indicated that educators generally comprehend the principles of deep learning; however, they frequently struggle to discern practices that genuinely

facilitate profound understanding as opposed to superficial learning or rote (Duan, 2022; Niu & Liu, 2022). This situation shows that teachers need more help to better understand the difference between deep learning and surface learning. This could come from professional training or mentoring (Olop et al., 2024; Saqr et al., 2023).

The fairly uniform range of standard deviations shows that the respondents' views are consistent, which suggests that these views are fairly similar. Educational literature indicates that this uniformity of perception signifies a collective comprehension that can underpin curriculum development or more specialised teacher training (Jakhelln & Postholm, 2022; Whinnery et al., 2020). Consequently, these findings validate that while educators possess a robust foundational comprehension of deep learning, the distinction from rote learning continues to be a domain necessitating focus in professional development.

Second, teachers showed that they were interested in using deep learning and had positive attitudes toward it, but they still had some doubts about how to do it in early childhood education. The highest score on the indicator about interest in creating learning activities that gets children to ask questions shows that teachers understand how important curiosity and reflective questioning are for meaningful learning. This is in line with earlier research that showed that teachers' motivation to create question-based activities is a key factor in how well deep learning strategies work (Aidoo et al., 2024).

On the other hand, the lowest score on the belief that deep learning can be used in early childhood education shows a practical ambivalence. This means that teachers may agree with the idea in theory, but they are not sure yet that it fits with how children develop or how the classroom is set up. Yasser F. Hendawy Al-Mahdy and Fayrouz Ramadan Elwakil (2026) demonstrated that perceptions of environmental readiness, curriculum, and institutional support substantially affect teachers' confidence in implementing pedagogical innovations. The low range of standard deviations shows that the responses are consistent, which supports the idea that this uncertainty is shared by many people rather than just one.

These findings indicate that, despite teachers demonstrating positive attitudes and significant interest, reinforcement through practical examples, policy support, and contextualised training is essential to bolster their confidence in the implementation of deep learning in early childhood education and to convert this confidence into tangible practice (Guiwen J., 2023). Policy support, including resource allocation, ongoing training, and institutional incentives, fosters an environment conducive to innovation and motivates educators to explore novel methodologies (Janiesch et al., 2021). At the same time, contextualised training that is relevant to the challenges and characteristics of early childhood education makes sure that teachers learn skills that they can use in real life (Guiwen L., 2023; Rolina et al., 2025).

Third, most teachers said they used teaching methods that help students learn deeply, but there was some difference in how confident and difficult they thought they were.

The highest score on the indicator that encourages children to talk about what they've learned shows that teachers are actively trying to give children chances to think about what they've learned and express themselves. This is in line with the ideas of deep learning, which stress active involvement and meaningful learning experiences. This finding is consistent with the work of Marcel Bassachs et al. (2020), who emphasised the significance of children's reflection and narration in facilitating meaningful learning and critical thinking. Narratives, including storytelling and counter-storytelling, facilitate children's expression of their thoughts and emotions while linking personal experiences to the concepts being taught (Kim & Hachey, 2020; Luciano et al., 2022; O'Reilly et al., 2022). This method also helps children stay interested in learning by making them active participants.

On the other hand, the lowest score on the idea that deep learning is too hard to use shows that some teachers still have trouble using this method, but not so much that they reject it completely. This shows a realistic and practical belief, where teachers know that it will be hard to put into practice but are still willing to do so. The low range of standard deviations suggests that this view is relatively consistent among respondents, indicating that the practices adopted are homogeneous within their classroom contexts. Consequently, these findings affirm that educators have commenced the internalisation of deep learning practices within their daily routines. Nonetheless, elements of difficulty or technical impediments require resolution via professional assistance and sufficient resources (Komala et al., 2025).

Fourth, teachers acknowledged contextual factors affecting the implementation of deep learning in the classroom, with responses predominantly classified as "neutral to agree." The indicator with the highest score (mean = 3.13) shows that teachers think that support from school or institutional leaders is very important for the success of new teaching methods. This is in line with research that shows that schools' adoption of new practices is strongly influenced by managerial and policy support. Visionary, collaborative, and responsive leadership can cultivate a dynamic school ecosystem that encourages creativity and enables transformation towards innovation (Pettalongi, 2025; Riddel & Zulfikar, 2024).

Open, adaptable, and creative supportive school policies, like ongoing professional development, providing resources, and giving teachers incentives, make teachers more motivated and confident to try and keep up with new practices (Sidhu G. K. & Gage, 2021). Effective communication, sharing a vision for innovation, and giving teachers room to try new things and work together are also parts of managerial support (Sánchez V. & Gutiérrez-Esteban, 2023). Without such support, resistance, lack of resources, or unclear policy direction can make it harder for people to adopt new ideas (Narmin, 2024).

On the other hand, the lowest score on the perception that the institutional curriculum does not yet support deep learning (mean = 2.41) shows that teachers still see structural barriers, even though they are aware of and recognise institutional support.

The moderate range of standard deviations indicates that teachers' perspectives are relatively uniform, although there is minor variation in their perceptions of the challenges and supports they encounter. These findings emphasize that, despite teachers' motivation and interest in facilitating deep learning, external factors such as curriculum design, available facilities, and institutional support are essential determinants of effective classroom implementation. This underscores the necessity for systemic interventions to mitigate these barriers. Previous studies on early childhood education management in Indonesia have similarly highlighted that school resilience and educational quality are strongly influenced by quality human resource management, curriculum support, institutional leadership, and continuous teacher professional development (Arifiyanti et al., 2025).

In addition to the dimensional analysis, the network analysis provided further insight into the interrelationships among teachers' perceptions, attitudes, and practices related to deep learning implementation. Network analysis has increasingly been recognised as a useful approach for examining complex relational patterns among educational variables and identifying interconnected clusters of attitudes and behaviour in educational settings (Froehlich et al., 2020). The analysis revealed several closely connected clusters among items associated with inquiry-oriented learning, reflective teaching practices, and institutional support. In particular, strong associations were identified between teachers' interest in encouraging children to ask questions and their interest in promoting children's thinking processes, indicating that inquiry-based attitudes tend to co-occur within early childhood education practices.

The network structure also demonstrated that belief in the applicability of deep learning in early childhood education occupied a relatively central position, suggesting that teachers' confidence in the feasibility of deep learning may influence both their instructional attitudes and classroom practices (Peters et al., 2021; Wolstein et al., 2021). Additionally, support-related items, including institutional support and professional training needs, formed interconnected relationships, highlighting the importance of systemic and organisational factors in facilitating pedagogical innovation (Janiesch et al., 2021; Sánchez M. C. & Gutiérrez-Esteban, 2023). These findings reinforce the view that the implementation of deep learning in early childhood education is not shaped by isolated factors, but rather by interconnected cognitive, pedagogical, and institutional dimensions (Froehlich et al., 2020). Therefore, strengthening teachers' conceptual understanding alone may not be sufficient without simultaneous support through training, curriculum alignment, and institutional encouragement (Amemasor et al., 2025)

There are a few things that this study cannot do. First, it used a self-report questionnaire, which means that the results depend a lot on how teachers see themselves and how they rate themselves. This method creates the possibility of social desirability bias, where respondents might give answers they think are expected or right instead of fully explaining how they really teach in the classroom. Second, the study

utilised a considerable sample; however, it was confined to educators from a singular regional context, thereby limiting the generalizability of the results to the wider population of early childhood education teachers.

Third, various indicators, specifically those pertaining to teaching practices (deep learning-based teaching practices) and implementation barriers, assessed teachers' perceptions without direct classroom observation. Consequently, while teachers indicated that they promote critical thinking and reflection among students, the actual implementation of these practices in the classroom remains unverified. Fourth, this study utilised a cross-sectional design, which constrains the capacity to detect alterations in teachers' perceptions, interests, or practices over time. Teaching experience, supplementary professional training, or curriculum reforms may affect teachers' comprehension and methodologies; however, these variables could not be analysed longitudinally.

Conclusion

This study shows that most early childhood education teachers have a positive view of using deep learning. They show a pretty good understanding of the concepts, but a lot of them still have trouble telling the difference between deep learning and rote learning. Teachers have a lot of interest and enthusiasm, but some people are still unsure about how practical it will be. The teaching practices they describe support deep learning, especially by getting children to think about what they're learning, even though they know it can be hard to put into action. Finally, teachers understand how important it is for schools to support them, even though the current curriculum doesn't fully support this way of teaching. These findings establish a preliminary framework for policymaking aimed at facilitating deep learning in early childhood education through a comprehensive strategy. This strategy encompasses continuous professional development to assist educators in distinguishing deep learning from rote memorisation, pilot programmes to enhance teachers' confidence in practical implementation, technical support including streamlined procedures and sufficient learning resources, reinforced institutional commitment via leadership policies and appropriate budget allocation, and the transformation of the educational ecosystem comprising infrastructure, human resources, and community engagement to promote sustainable and meaningful deep learning practices tailored to the characteristics of young children within the Indonesian context.

Acknowledgements

This research was supported by Universitas Negeri Yogyakarta (UNY) under the institutional research funding programme. Project number: T/1257/UN34.9/PT.01.03/2025. The authors gratefully acknowledge the financial support provided by Universitas Negeri Yogyakarta for the completion of this study.

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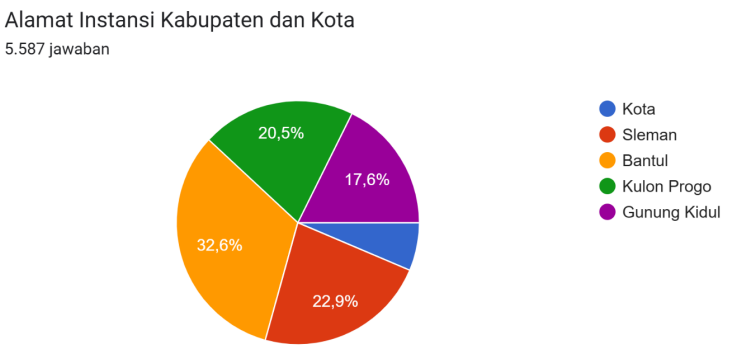
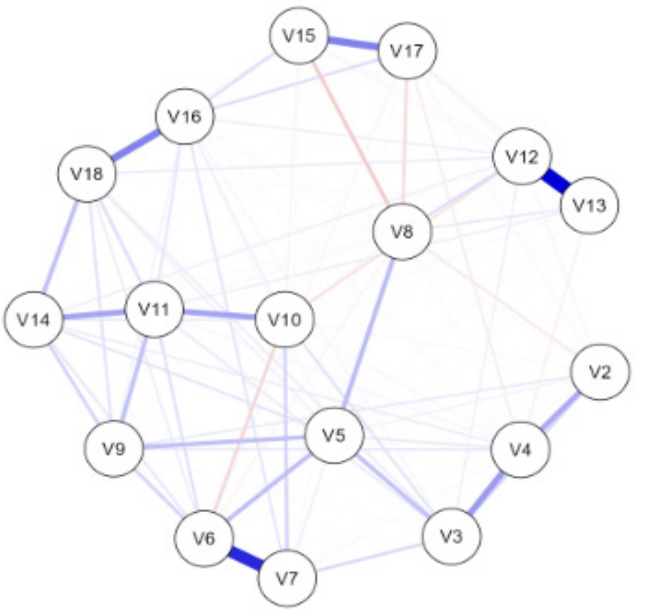
Appendix A

Figure A1
Participant's Area of Origin



Source. Own research.

Figure A2
Network Analysis of Teachers' Perspectives on Deep Learning



Source. Own research.

Appendix B

Table B1

Respondent Demography

Variabel	N	%
Gender		
Man	37	0,7
Woman	5.550	99,3
Non-formal type of ece		
Play group	3.186	57%
Daycare	495	8,9
Others	1.906	34,1
Educational background		
Junior high school	68	1,2
Senior high school	3.247	58,1
Diploma	456	8,2
Bachelor's degree in ece	706	12,6
Non-bachelor's degree in ece	1.049	18,8
Magister	48	0,9
Doctoral	3	0,1
School's accreditation status		
Accredited	5.372	96,2
Not accredited	215	3,8
Participation in early childhood education (ece) training		
Attended	5.156	92,3
Never attended	431	7,7

Source. Own research.

Table B2

Measured Perspectives on Deep Learning

Questionnaire items	Mean (m)	Std. Dev. (sd)	t	p-value	Cohen's d
Teachers' perspectives on deep learning	2.94	0.65	53.42	<.001	0.68
Understanding the concept of deep learning	2.96	0.64			
Attitudes and interest in applying deep learning	3.07	0.63			

Questionnaire items	Mean (m)	Std. Dev. (sd)	t	p-value	Cohen's d
Deep learning-based teaching practices	2.95	0.60			
Barriers and support in implementation	2.77	0.71			

Source. Own research.

Table B3

Measured Teacher's Understanding The Concept of Deep Learning

Questionnaire items	Mean (m)	Std. Dev. (sd)	t	p-value	Cohen's d
Understanding the concept of deep learning	2.96	0.64	71.42	<.001	0.92
Know that deep learning is a learning approach that encourages children to understand concepts in depth.	3.11	0.61			
Can distinguish deep learning from rote learning.	2.80	0.69			
Understand that deep learning promotes critical thinking from an early age.	3.06	0.58			
Have read about deep learning-based learning.	2.91	0.62			

Source. Own research.

Table B4

Measured Teacher's Attitudes and Interest in Applying Deep Learning

Questionnaire items	Mean (m)	Std. Dev. (sd)	t	p-value	Cohen's d
Attitudes and interest in applying deep learning	3.07	0.63	71.24	<.001	0.95
Believe that the deep learning approach can be applied to early childhood education.	3.04	0.64			
Interested in developing learning activities that encourage children to ask questions.	3.11	0.63			
Interested in developing learning activities that encourage children to think.	3.07	0.65			

Source. Own research.

Table B5

Measured Teacher's Deep Learning-Based Teaching Practices

Questionnaire items	Mean (m)	Std. Dev. (sd)	t	p-value	Cohen's d
Deep learning-based teaching practices	2.95	0.60	19.53	<.001	0.26
Deep learning is too difficult to implement in early childhood education	2.79	0.56			
Believe that young children are capable of simple reflection if guided.	3.02	0.61			
Often ask questions that make children think more deeply.	2.80	0.56			
Encourage children to explain their learning experiences	3.04	0.63			
Focus only on rote memorisation activities in class	3.02	0.60			
Focus only on motor skills activities in class	2.99	0.55			
Create a classroom atmosphere that promotes discussion and exploration with children.	3.03	0.63			

Source. Own research.

Table B6

Measured Teacher's Barriers and Support in Implementation

Questionnaire items	Mean (m)	Std. Dev. (sd)	t	p-value	Cohen's d
Barriers and support in implementation	2.77	0.71	53.97	<.001	0.72
Find it difficult to implement deep learning due to limited facilities.	2.47	0.63			
Need further training on learning that encourages deep thinking.	3.10	0.62			
The curriculum in my institution does not yet support the deep learning approach.	2.41	0.63			
Support from school leaders or institutions is very important for innovative learning such as deep learning.	3.13	0.63			

Source. Own research.