Cakrawala Dini:

Jurnal Pendidikan Anak Usia Dini

Journal homepage: https://ejournal.upi.edu/index.php/cakrawaladini

Developing a Reflective Teacher Guidebook for Deep Learning Pedagogy to Foster Critical Thinking in Children Aged 5–6 Years

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ABSTRACT

Early childhood students' critical thinking skills are greatly influenced by teachers' ability to design learning experiences that explore children's cognitive development and reflect on children's responses during the learning process. This study developed and evaluated a reflective teacher guidebook that integrates Indonesia's deep learning pedagogy with structured reflective practice for teachers of children aged 5–6 years. Using the 4D development sequence, the study involved three expert validators, three teachers in a readability test, four teachers in a limited trial, 14 teachers in a field practicality trial, and 15 and 60 children in limited and field pretest and posttest trials. Content and media validation reached 89.7% and 98.3%, with a mean Aiken's V of 0.85. Practicality reached 91.7% and 93.3%, although the field practicality questionnaire showed low internal consistency (α = 0.461) and is therefore interpreted descriptively. Children's critical thinking scores increased significantly in both trials (Z = −3.623 and −7.270; p < .001), with medium normalized gains (0.593 and 0.664) and large effect sizes (r = 0.935 and 0.939). The guidebook offers teachers a practical structure for linking reflection, inquiry-oriented planning, and evidence of children's thinking; however, the absence of a comparison group means that causal effectiveness should be tested in controlled multi-site research.

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ARTICLE INFO

Article History:
Submitted/Received 04 Sep 2026
First Revised 25 Sep 2026
Accepted 04 Oct 2026
First Available online 06 Nov 2026
Publication Date 01 Nov 2026

Keyword:
Critical thinking,
Deep learning pedagogy,
Early childhood education,
Reflective teaching,
Teacher guidebook.

1. INTRODUCTION

Critical thinking in early childhood is visible in everyday acts such as observing closely, asking questions, giving reasons, making predictions, and trying solutions. These forms of thinking are developmentally different from formal adult argumentation, yet they can be strengthened when classroom interaction gives children time to wonder, explain, test ideas, and reconsider what they think (O'Reilly et al., 2022; Pollarolo et al., 2023). Recent Indonesian work points in the same direction. Teacher support and the design of exploratory learning environments are among the factors associated with opportunities for young children to think critically, while scientific and STEAM-oriented activities can make observation, questioning, and explanation more visible in classroom practice (Sope & Murtono, 2024; Ramanathan et al., 2022).

Creating those opportunities depends on more than selecting an engaging activity. Teachers have to anticipate productive questions, notice how children respond, and decide whether the next instructional move should extend, redirect, or revisit an idea. Reflective practice is relevant because it turns these decisions into an iterative professional process rather than an end-of-lesson administrative task. Contemporary studies describe reflection as occurring before, during, and after teaching and as varying in depth according to the evidence teachers use to reconsider their practice (Chen, 2023). Intentional teaching likewise depends on careful and collaborative professional judgment, while structured portfolios can help educators move from planning to review, critique, and redesign (Leggett, 2025; Khales et al., 2025). In play-based STEAM settings, the teacher's role in enabling exploration and experimentation also highlights the need for practical professional support rather than relying on activities alone (Mwariko & Kurniati, 2024).

This issue is particularly relevant in Indonesia following the introduction of Pembelajaran Mendalam, referred to here as deep learning pedagogy and distinguished from artificial-intelligence deep learning. The national framework emphasizes mindful, meaningful, and joyful learning in which learners understand, apply, and reflect on knowledge in authentic situations (Kementerian Pendidikan Dasar dan Menengah, 2025). Early analysis of its use in Indonesian early childhood education suggests promising possibilities but also uneven implementation related to teacher preparation and school-level interpretation (Rahman & Cahyawati, 2025). Studies of inquiry-oriented learning have reported gains in young children's critical thinking when exploration, questioning, and problem solving are deliberately organized (Priyanti & Warmansyah, 2021; Yuliani et al., 2023; Agustini et al., 2024; Rosidah et al., 2024). Most of this intervention literature, however, concentrates on the learning model or activity experienced by children. Less attention is given to an operational system that helps teachers use evidence from one lesson to reflect on and redesign the next lesson.

The preliminary study for the present development showed that this gap was also evident in local practice. Interviews with four Group B teachers at TK Anak Ceria in Bandung found that none had received specific training in reflective teaching or deep learning pedagogy, and all reported difficulty formulating higher-order questions suitable for children aged 5–6 years. All four teachers reported that the school had no formal reflective procedure or internal community of practice, and three indicated that written reflection was not institutionally required. Review of five instructional planning documents found no higher-order questions and no written teacher reflection, while classroom observation indicated that approximately 80% of activities were predominantly instructional. The problem was therefore not simply a lack of activity examples; teachers needed a workable

DOI: http://dx.doi.org/10.17509/cd.v17i2.106040
p- ISSN 2087-1317 e- ISSN 2621-8321

way to connect planning, classroom evidence, reflection, and subsequent instructional decisions.

Based on these conditions, the study developed a reflective teacher guidebook that combines a five-phase reflective cycle, a four-phase deep learning sequence, reflection templates, exploratory science modules, and an observation rubric for children's critical thinking. Its contribution lies in treating reflection as the mechanism that connects pedagogical intentions with evidence of children's questions, predictions, explanations, and problem-solving attempts, rather than as a separate administrative exercise. The study examined three related questions: whether the guidebook was valid and practical for early childhood teachers, whether implementation was accompanied by changes in children's critical thinking scores, and whether teachers' reflective practice changed during implementation. Because the child outcome trials used a single-group pretest and posttest design, the study evaluates within-group change and does not claim a definitive causal effect.

2. METHODS

The study followed the Four-D (4D) development sequence of Define, Design, Develop, and Disseminate, a structure also used in recent early childhood product development research (Khadijah et al., 2025). During Define, conducted from February to March 2026, data were collected at TK Anak Ceria in Bandung through semi-structured interviews with four Group B teachers, classroom observation, a teacher needs questionnaire, and review of five instructional planning documents. The Design stage translated these needs into a prototype containing a five-phase reflective cycle, a four-phase deep learning sequence, five reflection templates, three exploratory science modules, and a child critical thinking observation rubric. During Develop, three experts reviewed the content, media or product design, and research instruments. Three teachers outside the main trial completed a readability test, four teachers implemented the guidebook for four weeks in a limited trial, and 14 teachers participated in the broader field practicality trial. Disseminate included implementation and socialization at another early childhood institution, followed by a satisfaction questionnaire completed by six teachers.

Data collection combined interviews, observation, questionnaires, document review, and pretest and posttest observation. Children's critical thinking was observed during classroom activity using a seven-item rubric informed by Ennis's general critical thinking framework and adapted to developmentally observable behavior in early childhood (Ennis, 2018; O'Reilly et al., 2022). The final items assessed whether a child asked a relevant question, gave a simple reason, observed an object closely and identified its characteristics, compared or classified objects by attributes, made a prediction, attempted more than one solution to a simple problem, and stated a simple conclusion. Teachers rated each item from 1 (not yet observed) to 4 (consistently observed), producing a maximum score of 28. The same rubric was completed before and after guidebook implementation for 15 children in the limited trial and 60 children in the field trial. Teacher reflective implementation was observed at the beginning and end of the limited trial using a 48-point instrument. Validation and practicality instruments used five-point response scales, and expert comments and field notes were used to revise the product between prototypes.

Quantitative analysis combined descriptive and inferential procedures. Product feasibility and user responses were expressed as percentages. Content validity was summarized with Aiken's V, a coefficient based on expert ratings (Kania et al., 2024), calculated using Equation (1):

DOI: http://dx.doi.org/10.17509/cd.v17i2.106040
p- ISSN 2087-1317 e- ISSN 2621-8321

$$V = \frac{\Sigma s}{[n(c-1)]}$$

where $s = r - l_0$, r is the score given by the rater, l_0 is the lowest possible rating score, n is the number of raters, and c is the number of scale categories.
Product feasibility and user responses for field practicality were expressed as percentages using Equation (2):

$$P = \left(\frac{\Sigma X}{\Sigma X_{max}}\right) \times 100\%$$

where P is the practicality percentage, $\sum X$ is the total score obtained, and $\sum X_{max}$ is the maximum possible score. The internal consistency of the 15-item field practicality questionnaire was examined with Cronbach's alpha.

For child outcome evaluation, Shapiro–Wilk tests showed that pretest-to-posttest difference scores were non-normal in both trials, so changes were examined with the Wilcoxon signed-rank test. The effect size (r) was calculated from the Wilcoxon Z statistic using Equation (3):

$$r = \frac{|Z|}{\sqrt{N}}$$

where Z is the standardized test statistic and N is the total number of observations. Furthermore, normalized gain (g) was used to describe improvement relative to the maximum obtainable score (Coletta & Steinert, 2020), as formulated in Equation (4):

$$g = \frac{M_{post} - M_{pre}}{S_{max} - M_{pre}}$$

where M_{post} is the mean posttest score, M_{pre} is the mean pretest score, and S_{max} is the maximum possible score.

The same nonparametric logic was applied to the four-teacher reflective implementation comparison. Because the design did not include a comparison group, statistically significant improvement was interpreted as within-group change associated with implementation rather than proof that the guidebook alone produced the change.

3. RESULTS AND DISCUSSION

3.1. Needs Analysis: From Administrative Planning to Reflective Design

The Define stage showed convergence across interviews, classroom observation, the teacher needs questionnaire, and document review. Teachers preferred a concise, visually accessible guide that could be used independently and that translated broad concepts into concrete classroom examples. Baseline evidence also showed that reflection and reasoning-oriented planning were largely absent from routine practice. None of the five reviewed modules contained higher-order questions or a written teacher reflection component, and classroom activity was predominantly instructional. **Table 1** summarizes how these findings were converted into product requirements.

DOI: http://dx.doi.org/10.17509/cd.v17i2.106040
p- ISSN 2087-1317 e- ISSN 2621-8321

Table 1. Needs-analysis findings and design implications

Evidence source	Key finding	Observed gap	Design response
Interviews (4 teachers)	All teachers needed a practical reflection guide and none had received specific training in reflective teaching or deep learning pedagogy.	Reflection remained informal and teachers lacked operational prompts.	Five-phase reflective cycle and ready-to-use Templates A–E.
Classroom observation	Approximately 80% of activities were predominantly instructional.	Limited exploration, dialogue, and opportunities for children to explain their reasoning.	Four learning phases: Exploration, Dialogue, Meaning Transfer, and Reflection.
Planning documents (5 modules)	0/5 contained higher-order questions and 0/5 contained written teacher reflection.	Planning emphasized activity completion rather than evidence of children's thinking.	Question prompts, child critical thinking indicators, and post-lesson reflection fields.
Teacher needs questionnaire	Teachers preferred a concise, full-color guide with concrete examples.	Existing guidance was difficult to translate into daily practice.	Portable A5 guidebook, sample modules, visual navigation, and an observation rubric.

The needs analysis suggests that professional support is most useful when it is embedded in teachers' actual planning and classroom decisions. Studies of early childhood STEAM and scientific learning similarly emphasize that exploration becomes productive when teachers know how to facilitate questioning, experimentation, and discussion rather than simply provide materials or activities (Mwariko & Kurniati, 2024; Sartika et al., 2025). This is also consistent with research on reflective practice, which shows the value of structured prompts that help educators review evidence and reconstruct subsequent teaching (Chen, 2023; Khales et al., 2025). The guidebook therefore uses reflection as the connection between curricular intentions, children's responses, and the next instructional decision.

3.2. Product Architecture, Validation, and Practicality

The final guidebook organizes reflection and deep learning pedagogy as two connected cycles. The five reflection phases are awareness, analysis, evaluation, redesign, and reflection on action. Together, they convert reflective practice into short prompts that teachers can use before, during, and after instruction, consistent with contemporary accounts of reflection as a process that changes across moments of professional action (Chen, 2023; Leggett, 2025). The reflective cycle is paired with four learning phases: exploration, dialogue, meaning transfer, and reflection. Teachers first identify what children need, design opportunities to investigate and discuss, observe evidence of children's reasoning, and use that evidence when planning the next lesson. **Figure 1** illustrates how the processes carried out by this teacher relate to the expected learning outcomes for the children.

DOI: http://dx.doi.org/10.17509/cd.v17i2.106040
p- ISSN 2087-1317 e- ISSN 2621-8321

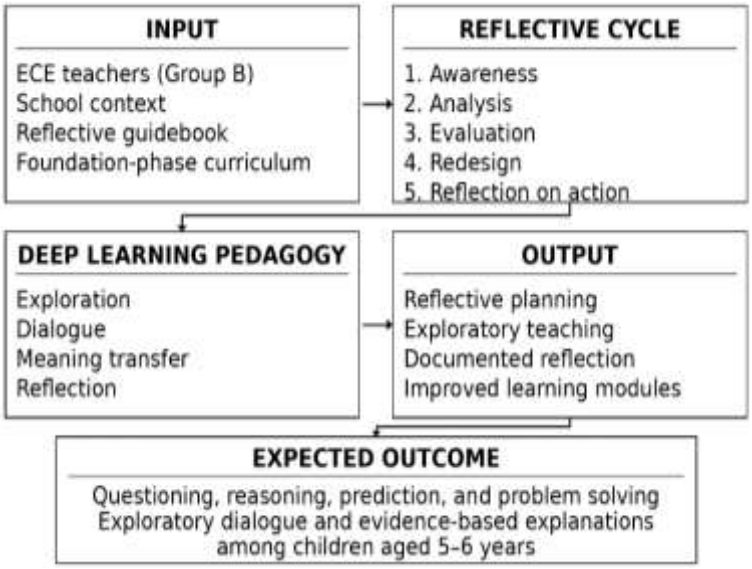


Figure 1. Architecture of the Developed Reflective Teacher Guidebook

The final product was a full-color A5 guidebook of 103 pages organized into ten chapters. Core components included the five-phase reflective cycle, four deep learning phases, five reflection templates, three exploratory science modules on water flow, light, and sinking and floating, and a rubric for observing children's critical thinking. **Figure 2** shows the front and back appearance of the developed guidebook.



Figure 2. Front and back appearance of the Reflective Teacher Guidebook prototype

Expert review examined the substantive content, media and product design, and the research instruments before the guidebook was used in the trials. **Table 2** presents the scope of each validation panel and the domain-level results. Content validation reached 89.7%, while media and product validation reached 98.3%. Instrument review yielded 79.1% before the requested revisions were incorporated. Across the instruments and product, Aiken's V ranged from 0.81 to 0.92, with a mean of 0.85. The child critical thinking observation rubric obtained V = 0.81.

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Table 2. Domain-level expert validation of the guidebook and research instruments

Validation panel	Scope	Domain-level results	Overall result
Content expert	35 items; 7 aspects	Reflective teaching 84.0%; deep learning 86.7%; child critical thinking 94.3%; ECE characteristics 86.7%; content completeness 92.0%; product usefulness 92.0%; implementation 90.0%	89.7% Highly feasible
Media / product expert	35 items; 7 aspects	Cover 100%; layout 93.3%; typography/readability 96.0%; illustration 100%; presentation structure 100%; ease of use 100%; overall product quality 100%	98.3% Highly feasible
Research instrument expert	44 indicators; 7 components	Define 4.00; Design 3.80; Develop 4.20; Disseminate 4.00; interview guide 3.88; observation sheet 3.75; documentation sheet 4.13 (mean scores on 1–5 scale)	79.1% (M = 3.95) Feasible with revision

Teacher evaluation provided additional evidence about usability. Readability among three teachers reached 88.67%. Practicality was 91.7% in the limited trial and 93.3% in the field trial, and six teachers in the dissemination phase reported an average satisfaction score of 93.2%. The field practicality questionnaire nevertheless showed low internal consistency (Cronbach's α = 0.461). The thesis analysis indicated very homogeneous, predominantly high responses; therefore, the practicality percentages are treated primarily as descriptive evidence of user acceptance rather than as a precise latent-scale estimate. This caution does not negate the practical value of the guidebook, but it limits the precision attached to the percentages. The short reflection formats used before, during, and after teaching are consistent with evidence that structured documentation can help teachers move from planning to review and redesign without requiring a lengthy reflective narrative (Khales et al., 2025).

3.3. Changes in Children's Critical Thinking

Changes in children's critical thinking were assessed with the same seven-item observation rubric before and after guidebook implementation. Each item was rated from 1 to 4, giving a maximum total score of 28. The limited trial included 15 children and the field trial included 60 children. Because the distributions of the pretest-to-posttest difference scores were non-normal, the comparisons used the Wilcoxon signed-rank test. **Table 3** summarizes the descriptive scores, normalized gains, and inferential results for both trials.

Table 3. Pretest and posttest child critical thinking results

Trial	n	Pretest M	Posttest M	Mean Δ	Wilcoxon Z	N-Gain	Effect size r
Limited	15	9.667	20.533	10.867	−3.623, p < .001	0.593 (medium)	0.935 (large)
Field	60	10.017	21.950	11.933	−7.270, p < .001	0.664 (medium)	0.939 (large)

As shown in Table 3, the mean critical thinking score increased from 9.667 to 20.533 in the limited trial and from 10.017 to 21.950 in the field trial. All 15 children in the limited trial and all 60 children in the field trial had positive ranks, with no negative ranks or ties. The Wilcoxon tests were significant in both trials (p < .001), with large effect sizes (r = 0.935 and

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p- ISSN 2087-1317 e- ISSN 2621-8321

0.939) and medium normalized gains (0.593 and 0.664). These indices show a large and consistent within-group shift from pretest to posttest, but they do not by themselves establish that the guidebook caused the change. **Figure 3** provides a visual comparison of the mean scores.

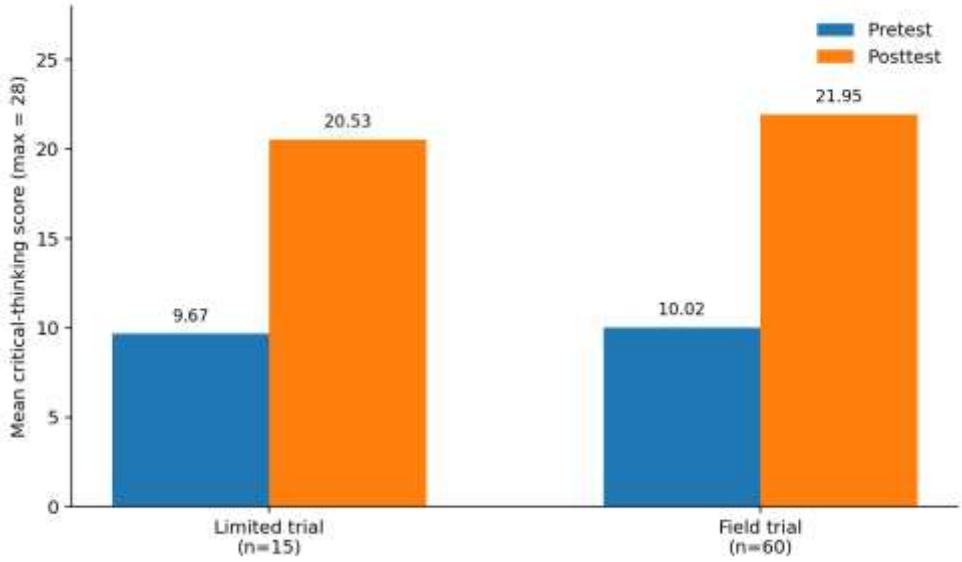


Figure 3. Mean critical thinking scores before and after implementation

The observed direction of change is plausible in relation to the classroom processes emphasized by the guidebook. Preschool critical thinking is commonly supported through inquiry-oriented interaction, thinking language, and questioning (O'Reilly et al., 2022). In the present guidebook, the exploration and dialogue phases ask teachers to use open prompts, delay premature answers, and invite children to compare observations. Meaning Transfer then encourages children to connect what they found with another situation. These moves provide repeated opportunities for questioning, observation, comparison, prediction, reasoning, problem solving, and conclusion drawing to become visible during ordinary classroom activity.

The findings align with Indonesian studies in which inquiry-oriented experiences were associated with higher critical thinking among young children, including inquiry learning, inquiry projects, science modules, and STEAM activities (Priyanti & Warmansyah, 2021; Yuliani et al., 2023; Agustini et al., 2024; Sope & Murtono, 2024). The present study differs in the unit of support. Rather than introducing only a child-facing learning model, it provides teachers with a reflection and planning system intended to improve how a sequence of exploratory lessons is designed over time. Sartika et al. (2025) likewise highlight the importance of educator facilitation in scientific learning; the current results extend that emphasis by showing how classroom evidence can be carried forward into the teacher's next planning cycle. This comparison suggests that reflective teacher support may complement, rather than replace, inquiry-based learning models.

The child outcome results should not be interpreted as a definitive causal estimate. The trials did not include a comparison group, the same observation rubric was used before and after implementation, and the field phase occurred within a development study rather than a randomized effectiveness trial. Maturation, teacher expectancy, repeated observation, or other classroom experiences could have contributed to the change. The large effect sizes describe the magnitude of within-group change but do not remove these threats to internal validity. A controlled or cluster-based study using independent observers and explicit inter-

DOI: http://dx.doi.org/10.17509/cd.v17i2.106040
p- ISSN 2087-1317 e- ISSN 2621-8321

rater reliability procedures would be needed to estimate the guidebook's causal contribution more precisely.

3.4. Teacher Reflective Practice and Dissemination Evidence

Observation of the four teachers in the limited trial provided a process indicator of reflective implementation. The mean score increased from 26.25 of 48 (54.7%) at baseline to 40.75 (84.9%) at the end of implementation, an increase of 30.2 percentage points. All four teachers improved and the calculated effect size was large ($r = 0.945$). The Wilcoxon result, however, did not reach the .05 significance threshold ($Z = -1.890$, $p = .059$). With only four teachers, the appropriate interpretation is that practice changed in a consistent and promising direction, while inferential evidence remains insufficient. This distinction is important because the proposed mechanism of the guidebook depends on changes in teacher planning and reflection and therefore requires stronger testing with a larger teacher sample.

The dissemination phase provided evidence of acceptance outside the original development site. Six teachers at TK Aisyiyah 12 reported an average satisfaction score of 93.2%, with favorable ratings for usefulness, clarity, visual presentation, relevance to instructional needs, and intention to continue using the guidebook. This pattern is consistent with Mwariko and Kurniati (2024), who emphasize that sustained exploratory and play-based practice depends on teacher support, but the present evidence is narrower because it documents short-term user acceptance rather than changes in classroom process or child outcomes. Doyle et al. (2024) also showed the value of a community-of-practice model for early childhood professional learning. In comparison, the present findings suggest that the guidebook could function as a shared reflection artifact within such a model, although collaborative use was not directly tested in this study. The dissemination results should therefore be read as evidence of initial acceptance and a basis for future implementation research, not as evidence that use will be sustained over time.

3.5. Contribution and Implications

The study makes three interrelated contributions. First, it translates reflective teaching into a five-phase cycle with concise prompts that can be used in daily early childhood education lessons. Second, it links that cycle directly to Indonesia's deep learning pedagogy so that reflection informs exploration, dialogue, transfer of meaning, and subsequent planning. Third, it connects teacher reflection with observable evidence of children's thinking, allowing questions, predictions, reasons, comparisons, problem-solving attempts, and conclusions to inform the next design cycle. The contribution is therefore not the concept of reflection by itself, but its operational integration with instructional design and child evidence in one field-tested resource.

In practice, the guidebook can serve as a planning companion for exploratory science and other play-based topics in Group B classrooms, particularly when teachers need concrete support for writing open-ended questions and documenting post-lesson decisions. At the school level, the templates may also provide a common language for mentoring and professional discussion rather than functioning as compliance forms. Future studies should test the guidebook across multiple sites against a business-as-usual or other comparison condition, use independent or blinded observation where feasible, establish inter-rater reliability for child outcome scoring, examine fidelity across the five reflection phases, and follow teachers long enough to determine whether reflection becomes a sustained professional habit.

DOI: http://dx.doi.org/10.17509/cd.v17i2.106040
p- ISSN 2087-1317 e- ISSN 2621-8321

4. CONCLUSION

This research and development study produced a reflective teacher guidebook that integrates a five-phase reflective cycle with four phases of deep learning pedagogy, practical reflection templates, exploratory lesson examples, and an observation rubric for critical thinking in children aged 5–6 years. Expert and teacher evaluations indicated high feasibility, readability, and favorable usability, although the low internal consistency of the field practicality questionnaire means that practicality percentages should be interpreted descriptively. Children in both single-group trials showed significant and substantial within-group improvement in critical thinking scores, while teacher reflective implementation improved descriptively but did not reach statistical significance in the four-teacher inferential test. The main contribution of the guidebook is its use of structured reflection to connect instructional intentions, exploratory learning, classroom evidence, and subsequent redesign. It is a promising practical resource for early childhood teachers, but controlled multi-site research with larger teacher samples, stronger fidelity measures, and independent outcome assessment is required before causal effectiveness can be established.

5. AUTHORS' NOTE

The authors declare no conflict of interest regarding the publication of this article. The manuscript reports original work and was prepared in accordance with academic integrity requirements.

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DOI: http://dx.doi.org/10.17509/cd.v17i2.106040
p- ISSN 2087-1317 e- ISSN 2621-8321