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Exploring Natural Phenomena with Pop-Up Books: A Tool for Early Science Literacy

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Abstract

Early childhood science learning often remains dominated by verbal explanation and minimally interactive materials, limiting children's engagement with natural phenomena. This study developed a rain-themed pop-up book designed to operationalise early science literacy as a staged progression from contact and curiosity to concept formation and concept acquisition. Using a Research and Development approach adapted from Borg and Gall in six stages, the product was refined through expert validation of content, media design and durability, and language, followed by practitioner appraisal and a limited classroom trial with 15 children aged 5 to 6 years in Cirebon City, Indonesia. After revision, feasibility ratings reached 95% for content, 95.83% for media design and durability, and 87.5% for language, while practitioner appraisal showed high practicality (average 95.83%). Children's rubric-based observation scores increased from 49.53% before implementation to 83.79% after implementation across all indicators. These findings suggest that interactive, phenomenon-based print media can provide a grounded pathway for strengthening early science literacy in resource-constrained classrooms. The study contributes globally by offering a transferable design model linking familiar natural phenomena, staged literacy indicators, and tactile visual pedagogy in early childhood settings. Its practical implication is that teachers can integrate science inquiry into classroom activities through low-cost, contextually adaptable media. However, the evidence remains limited by the small sample, single-site trial, and absence of a comparison group and inter-rater reliability reporting. Future studies should test this model across diverse contexts, use comparative or longitudinal designs, and examine how similar media support science concepts and sustained literacy development.

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Introduction

Early childhood science learning in many settings remains dominated by verbal explanation and worksheet-style tasks, with limited opportunities for children to investigate everyday phenomena through concrete, visually supported experiences. When teachers introduce natural phenomena such as rain primarily through talk, young children often lack a stable mental model of processes that cannot be directly observed, which can reduce engagement and constrain inquiry-oriented classroom interaction (Hasan et al., 2021; Noor, 2020; Sholeha et al., 2021). This situation is consequential because early experiences with asking questions, noticing patterns, and explaining observations are not peripheral skills; they are the cognitive and dispositional foundations through which later scientific understanding is built (Avikasari et al., 2018; Bybee, 2008).

Science literacy in early childhood can be approached as the capacity to make sense of familiar events in the surrounding environment through meaningful exploration, language, and evidence-based reasoning that is developmentally appropriate. Early childhood is a particularly strategic period for cultivating these capacities because children's curiosity and exploratory tendencies are naturally high, and educators can scaffold scientific thinking through activities that connect observation, explanation, and representation (Gerde et al., 2018). In this view, early science literacy is less about accumulating factual knowledge and more about building inquiry dispositions and representational competence that support children's later learning trajectories (Bybee, 2008). Book-mediated discussion practices, such as structured "book talks" around picture trade books, have also been used to introduce Nature of Science ideas in early childhood settings, indicating that teacher-guided dialogue around books can deepen children's science meaning-making (Hansson et al., 2020).

At the system level, science literacy remains a persistent concern in Indonesia. OECD reporting on PISA 2022 indicates that students in Indonesia scored below the OECD average in science and that average 2022 results were down compared to 2018 across mathematics, reading, and science (OECD, 2023). Although PISA assesses 15-year-old students rather than early childhood learners, these results function as a downstream indicator of system-level science learning outcomes and underscore the strategic importance of strengthening foundational experiences earlier in the learning pipeline. From this perspective, improving early science learning is not a claim of direct causal resolution of PISA outcomes, but a plausible, prevention-oriented strategy for building the competencies and dispositions that later assessments ultimately reflect.

A key barrier to strengthening early science literacy is the limited availability and use of learning media that are concrete, visual, and interactive, despite the developmental need for such supports in early childhood classrooms. Existing resources that aim to introduce science concepts are often non-interactive or insufficiently contextual, which can position children as passive recipients rather than active meaning-makers (Lia, 2018; ZR & Eliza, 2020). Although prior studies have examined early science literacy and the use of learning media, the literature still shows limited work that explicitly aligns staged science literacy learning with a tangible medium anchored in a specific, everyday natural phenomenon that children encounter in daily life.

Pop-up books offer a promising pedagogical affordance because their three-dimensional visual structures can translate abstract processes into manipulable representations that invite attention, dialogue, and guided exploration (Anggraini et al., 2019; Avirudini & Sumarno, 2018; Bluemel & Taylor, 2012; Mustika & Ain, 2020). Empirical work also suggests that pop-up or visual-activity media can improve engagement and learning outcomes in classroom settings, supporting the idea that interactive visual representation can enhance children's participation and comprehension (Nikmah et al., 2019; Özgelen, 2012; Rahmawati & Rukiyati, 2018; Sari & Suryana, 2019). This rationale is consistent with broader evidence indicating that visual and multisensory supports can strengthen learning and cognitive integration in children, particularly when tasks require transfer or conceptual mapping beyond direct action (Eördegh et al., 2022; Lo & Wang, 2024; Schroeder & Kirkorian, 2016; Sun et al., 2019; Yilmaz et al., 2017). Related early-years work on children's understanding of water-related processes also indicates that representational dialogue and targeted interventions can improve young children's mental models of the water cycle and of water state changes, supporting the value of structured representations for topics such as rain (Ahi, 2017; Kambouri-Danos et al., 2019).

Building on these considerations, this study develops a natural-phenomena pop-up book focused on rain as a contextual theme for early childhood science literacy, and evaluates its feasibility through expert validation and practitioner appraisal. The study operationalises early science literacy through four stages used in this research context: contact, curiosity, concept formation, and concept acquisition (Abidin et al., 2017). The work has two aims. First, it establishes the feasibility of the natural-phenomena pop-up book based on assessments by material, media, and language experts and by users (principals and teachers). Second, it examines changes in children's observed science literacy indicators across the four stages during a limited trial implementation. The intended contribution is twofold: a developmentally grounded design of an interactive medium explicitly mapped to staged science literacy indicators, and feasibility evidence that clarifies the media's practicality and instructional promise in early childhood settings.

Methods

Research Design

This study employed a Research and Development (R&D) approach to design, validate, and trial a learning medium in the form of a natural-phenomena pop-up book (Borg & Gall, 1983; Gustiani, 2019). The R&D approach was selected because it enables iterative product improvement through needs analysis, expert review, revision, and a limited field trial aligned with the intended instructional outcomes.

Development Model and Stages

The development process was adapted from the Borg and Gall model into six stages to accommodate practical constraints while maintaining the logic of iterative development and evaluation. The stages were: (1) initial information gathering and needs analysis in early childhood settings; (2) product planning and storyboard preparation, including the alignment of content with early childhood learning needs; (3) prototype development of the pop-up book (layout, illustrations, interactive elements, and activities); (4) expert validation of content, media design, and language, followed by revision based on written feedback; (5) limited trial implementation with children and practitioner appraisal to examine usability and instructional practicality; and (6) final product refinement based on trial results and practitioner notes.

Setting and Participants

The limited trial was conducted in an early childhood education setting in Cirebon City. The participating children were 15 learners aged 5–6 years from Karang Mulya Playgroup. Practitioner appraisal was conducted with school practitioners (principals and teachers) who observed classroom implementation and assessed practicality and usefulness. Expert validation involved three categories of validators: a material/content expert with a background in Early Childhood Education, a media expert with expertise in early childhood learning media, and a language expert with a specialisation in Indonesian language.

Product Description

The developed medium was a pop-up book based on a natural phenomenon theme, focusing on rain. The book combined simple narratives with three-dimensional (3D) pop-up illustrations to support children's understanding of the rainy season, the process of rain formation, and related everyday experiences. The product also included embedded activities designed to engage children actively, such as sequencing stages of rain formation and simple tasks related to early literacy in science contexts (for example, identifying and writing relevant words and selecting appropriate rain gear). The physical specifications emphasised child-friendly use, including durable materials and binding to support repeated classroom handling.

Measures and Instruments

Product feasibility was assessed using expert validation questionnaires that covered three domains. The instruments were developed and refined following standard principles of scale construction and clarity in educational measurement (Azwar, 2010), and then organised into three domains: content/material feasibility (relevance, accuracy, and developmental appropriateness for early childhood), media feasibility (visual design, interactivity, usability, and physical durability), and language feasibility (communicativeness, readability, and clarity). In addition, principals and teachers completed practitioner appraisal questionnaires to evaluate the practicality and usefulness of the media for classroom implementation, with attention to ease of use, instructional support, and classroom suitability. Children's early science literacy was assessed using a structured observation guide mapped to four staged learning dimensions used in this study, namely contact, curiosity, concept formation, and concept acquisition (Abidin et al., 2017), with indicators capturing children's ability to recognise the rainy season, explain and sequence the rain formation process, and demonstrate functional understanding through simple, age-appropriate tasks aligned with the learning activities in the pop-up book.

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Procedure

Following the needs analysis and prototype development, expert validation was conducted to identify necessary revisions to the content, media design, and language. Revisions were implemented before the limited trial. The limited trial began with a pre-implementation observation to establish children's baseline performance on the science literacy indicators. The pop-up book was then implemented in classroom learning facilitated by the teacher, combining guided reading, discussion, and the embedded interactive activities. After implementation, a post-observation was conducted using the same indicators to document changes in observed performance. Practitioner appraisal was collected after classroom use to capture usability and practicality in authentic instructional conditions.

Data Analysis

Quantitative analysis used percentage-based feasibility and performance summaries, supported by descriptive interpretation of qualitative feedback from validators and practitioners. Feasibility percentages were calculated by comparing the obtained score with the maximum possible score for each validation instrument:

$$\text{Feasibility (\%)} = (\text{obtained score} / \text{maximum score}) \times 100.$$

Children's observed science literacy performance was summarised using the same percentage approach by aggregating indicator scores and converting them into pre- and post-implementation percentages. The change in performance was interpreted descriptively as evidence of improvement on the targeted indicators during the limited trial, alongside practitioner feedback regarding classroom feasibility.

Ethical Considerations

The study followed standard ethical procedures for research in early childhood education settings. Institutional and school permissions were obtained prior to implementation, and parental consent was secured for children's participation. Children's identities were protected through anonymised recording and reporting of observational results.

Result

Context and needs analysis informing product development

The development of the natural-phenomena pop-up book began with an analysis of classroom realities in early childhood education settings in Cirebon City. Preliminary observations and informal information gathering indicated that science literacy activities for young children were introduced in a limited manner and were frequently delivered through verbal explanation, worksheet completion, and textbook-based activities. Teachers commonly explained natural phenomena, including rain, without sufficient visual support or hands-on media. As a result, children's participation tended to be passive, and classroom interaction was largely centred on teacher talk rather than child-led questioning and exploration.

The needs analysis also identified a scarcity of interactive and contextual books designed specifically to introduce science concepts to children aged 5–6 years. Available resources were often non-interactive and did not provide concrete representations of scientific processes that are difficult to observe directly in daily life. These conditions suggested the need for a learning medium that could: (a) present scientific concepts through accessible representations, (b) stimulate curiosity and active participation, and (c) support teachers in organising developmentally appropriate science literacy activities within routine classroom instruction.

Design blueprint and content structure of the pop-up book

Based on the needs analysis, the researcher developed a product blueprint that outlined the learning content, page sequence, and interactive components to be included in the pop-up book. The design process involved the preparation of storyboards and a content outline that were then developed into a prototype in collaboration with a team to ensure that the illustrations, pop-up mechanics, and activity prompts were feasible for classroom use. The selected theme was a natural phenomenon familiar to children and commonly discussed in early childhood settings, namely rain.

The rain theme was operationalised into a simple narrative that introduced children to the rainy season, the process of rain formation, and everyday events associated with rainy weather. This thematic choice was grounded in field observations indicating that teachers often described rain verbally without media assistance, leaving children without a stable visual model of how rain occurs. In addition, the content focus aligned with early childhood curriculum expectations related to introducing the natural environment and basic processes in nature, including learning about rain formation as an important topic for early introduction (Zahro et al., 2019).

The pop-up book prototype combined three-dimensional (3D) illustrations with short, child-accessible narratives and page-level tasks. The design intent was to create a sequence that gradually moved from recognition of the rainy season and its features to a simple, staged representation of how rain forms, followed by activities that allowed children to express and demonstrate understanding through sequencing and everyday decision-related tasks (for example, identifying relevant words and choosing appropriate rain gear). The overall structure was intended to support teacher-guided reading and discussion while allowing children to interact physically with the visual elements of the book.

Integration of staged science literacy indicators into learning activities

To ensure that the product was not merely visually attractive but also instructionally grounded, the learning activities embedded in the pop-up book were explicitly mapped to staged science literacy indicators suitable for children aged 5–6 years. In this study, four staged dimensions were applied: contact, curiosity, concept formation, and concept acquisition (Abidin et al., 2017). Each stage was operationalised through observable indicators that could be assessed using the observation guide.

At the contact stage, the indicators focused on children's recognition of the rainy season and their initial understanding of how rain occurs. This stage was supported by introductory pages showing typical signs of rainy weather and a simplified representation of the beginning of the rain formation process. At the curiosity stage, children were expected to mention or describe the rain formation process in their own words, supported by page prompts and teacher questioning during guided reading. The concept formation stage required children to sequence the stages of rain formation correctly, which was facilitated through an ordering activity embedded in the book-based session. Finally, the concept acquisition stage was operationalised through two indicators: children's ability to write simple rain-related words (rain, dark clouds, sun, wind, and seawater) and their ability to choose appropriate rain gear. These activities were included to connect conceptual understanding to practical, everyday contexts and to observe whether children could apply their learning in familiar situations.

Expert validation results and product revisions

Expert validation was conducted to assess the feasibility of the pop-up book across content/material, media design, and language dimensions. The validation process also functioned as a structured mechanism for product refinement, as validators provided both quantitative feasibility ratings and written revision notes that were implemented before the limited trial.

Content/material validation was conducted in two rounds. In the first round, the material expert rated the product at 80%, categorised as feasible. The feedback focused on strengthening the integration between the learning content and the staged science literacy indicators so that the instructional intent of each page and activity was clearer. Revisions were implemented accordingly, including refinement of activity prompts to better reflect developmental appropriateness and clearer alignment between the narrative flow and the

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targeted indicators. After these revisions, the second-round material validation score increased to 95%, categorised as very feasible. The remaining note from the material expert concerned improving the introductory guidance for the children's writing activity so that the instructions were more explicit and child-appropriate.

Media validation was also conducted in two rounds, focusing on the visual appearance, usability, and physical durability of the pop-up book. The first-round media feasibility score was 66.66%, categorised as fairly feasible, indicating that the prototype required substantive improvements in design and/or durability to better suit early childhood classroom handling. Following the media expert's feedback, the researcher revised aspects of layout, visual clarity, and the sturdiness of the pop-up mechanisms. After revision, the second-round media validation score increased to 95.83%, categorised as feasible, and the product was considered ready for classroom trial with only minor refinement notes.

Language validation was conducted in one round by a language expert and yielded a feasibility score of 87.5%, categorised as feasible, based on communicativeness, readability, and clarity. This result indicated that the language used in narratives and instructions was generally appropriate for early childhood learning media, with suggestions oriented toward improving clarity and ensuring that word choice supported children's comprehension.

Practitioner appraisal and feasibility in classroom use

In addition to expert validation, practitioner appraisal was collected to examine the practicality and usefulness of the media in authentic classroom conditions. Practitioners assessed how easily the pop-up book could be implemented by teachers, how well it supported instructional goals, and whether it was suitable for children's interaction during learning sessions.

Practitioner appraisal indicated high feasibility for classroom use. The principal's appraisal score was 91.66% and the classroom teacher's appraisal score was 100%, producing an average of 95.83%. Practitioners noted that the pop-up book facilitated classroom engagement because the 3D visuals attracted children's attention and provided a concrete basis for discussion. The interactive activities embedded in the book were reported to support children's active participation rather than passive listening. Practitioners also indicated that the product was made from materials suitable for young children and designed for repeated handling in classroom activities, with an emphasis on durability and child-friendly construction (Rahmat et al., 2016). The book was developed using thick paper (230 gsm) and a hardcover binding to support long-term use and to reduce the risk of tearing during routine classroom interaction.

The pop-up book was also characterised by practitioners as an innovation because it integrated the rain theme with interactive tasks that extended beyond viewing illustrations. In implementation, the media was used to guide children through a sequence of activities related to rain, including recognising weather features, discussing the formation process, sequencing steps, and completing simple applied tasks. This design emphasis on active participation is consistent with the idea that play-oriented and activity-based literacy learning can increase children's engagement in early childhood classroom settings (Omaga & Alieto, 2019).

Children's science literacy outcomes in the limited trial

Children's science literacy indicators were observed before and after implementation of the pop-up book in a limited trial with 15 children aged 5–6 years. The observation results were summarised using indicator-level aggregated scores and overall performance percentages. Because the observation guide employed rubric-based scoring, Table 1 presents aggregated scores (the sum of observation scores across participating children) for each indicator rather than counts of children.

Overall, children's performance increased from 49.53% before implementation to 83.79% after implementation, indicating substantial improvement across the observed indicators during the limited trial. Improvements were observed at each staged dimension. At the contact stage, the aggregated score for recognising the rainy season increased from 22 to 34, and the aggregated score for understanding how rain occurs increased from 18 to 30. At the curiosity stage, the aggregated score for mentioning the rain formation process increased from 15 to 27. At the concept formation stage, the aggregated score for sequencing the rain formation process increased from 15 to 27. At the concept acquisition stage, the aggregated score for writing rain-related words increased from 19 to 36, and the aggregated score for choosing appropriate rain gear increased from 18 to 27.

The category interpretation associated with the overall percentage also shifted from "Starting to Develop" at pre-implementation to "Developing Very Well" at post-implementation, suggesting that, within the limited trial context, children demonstrated stronger observable science literacy behaviours after the pop-up book-based learning activities.

Table 1. Science Literacy Indicators for Children Aged 5–6 Years

No.	Stage	Observation Statement	Pre-implementation	Post-implementation
1.	Contact stage	The child is able to recognise the rainy season.	22	34
2.	Contact stage	The child is able to understand the process of how rain occurs.	18	30
3.	Curiosity stage	The child is able to mention the process of how rain occurs.	15	27
4.	Concept formation stage	The child is able to sequence the process of how rain occurs.	15	27
5.	Concept acquisition stage	The child is able to write the words (rain, dark clouds, sun, wind, and seawater).	19	36
6.	Concept acquisition stage	The child is able to choose rain gear.	18	27
	Overall %		49.53%	83.79%
	Category		Starting to Develop	Developing Very Well

Discussion

A staged, rain-themed pop-up book that couples three-dimensional representation with embedded activities offers a workable mechanism for translating an otherwise unobservable natural process into manipulable classroom talk and action, provided that content, design, and language are iteratively refined through expert review and classroom use. This study's contribution is not simply the production of an attractive book, but the explicit mapping of page-level activities to staged science literacy indicators for children aged 5–6 years. By embedding contact, curiosity, concept formation, and concept acquisition within a coherent narrative sequence about rain, the medium provided teachers with a structured pathway for guiding children from recognition of everyday weather features toward a simplified process explanation and applied tasks.

A central interpretive implication concerns how three-dimensional visual representation and manipulation may reduce the cognitive distance between everyday experience and symbolic explanation for young children. The pop-up format offers concrete, visually salient cues that can stabilise children's mental models of processes that are not directly observable, such as the formation of rain. This aligns with the view that pop-up books can connect children's real-world experiences with developmentally appropriate representations and support classroom instruction through guided exploration (Bluemel & Taylor, 2012; Mustika & Ain, 2020). In this study, teacher-guided reading and discussion were scaffolded by the 3D elements and activity prompts, which likely increased opportunities for children to articulate observations, respond to questions, and practise sequencing. These affordances are consistent with evidence that visual and multisensory supports can strengthen learning performance under conditions that require conceptual mapping and transfer (Eördegh et al., 2022; Lo & Wang, 2024; Schroeder & Kirkorian, 2016; Sun et al., 2019; Yilmaz et al., 2017).

The staged outcome pattern provides further support for the instructional logic of the design. Improvements were observed at the contact stage (recognising the rainy season and understanding how rain occurs), which is consistent with the idea that concrete visuals can support initial noticing and comprehension. Gains were also evident at the curiosity and concept formation stages, where children were better able to mention and sequence the rain formation process. The increases at the concept acquisition stage, operationalised through writing rain-related words and choosing appropriate rain gear, suggest that the media did not only support receptive understanding but also enabled children to demonstrate functional application in simple, age-appropriate tasks. Comparable early-years work on water-related concepts has shown that representational dialogue (for example, "talking drawings") and focused interventions can strengthen young children's models of the water cycle and of water state changes (Ahi, 2017; Kambouri-Danos et al., 2019). This staged pattern is aligned with early science literacy perspectives emphasising inquiry dispositions and representational competence rather than mere recall of facts (Bybee, 2008; Gerde et al., 2018).

Practitioner appraisal indicated that feasibility is not limited to expert judgement but extends to usability in routine classroom practice. Teachers and school leaders evaluated the medium as practical and supportive for instruction, which is important given that limitations in learning media and teacher reliance on conventional delivery are frequently cited obstacles in early childhood science literacy implementation (Hasan et al., 2021; Sholeha et al., 2021). The product's material choices, including thick paper and hardcover binding, were also appraised as suitable for repeated handling by young children, addressing durability concerns that often constrain the sustained use of learning media in early childhood classrooms (Rahmat et al., 2016). In addition, the integration of interactive tasks within the book supports a play-oriented approach that can sustain engagement while maintaining instructional direction, consistent with arguments that literacy learning through play can enhance children's participation (Omaga & Alieto, 2019).

However, the interpretation of the observed improvements should remain proportional to the study design. The limited trial involved a small number of children in a single setting, and the outcome evidence is based on structured observation with rubric-based scoring. Although the pre–post improvement is substantial, the study does not employ a control group or experimental comparison, and therefore cannot isolate the media's effect from other influences such as teacher facilitation, novelty effects, or maturation over the trial period. As a result, the outcome evidence should be positioned as promising improvement in observed indicators within the specific implementation context rather than as definitive evidence of effectiveness in broader populations.

The study also raises methodological considerations for future development research in early childhood science literacy. First, subsequent studies could strengthen causal claims by using quasi-experimental or experimental designs with comparison groups and longer follow-up periods. Second, observational instruments would benefit from more explicit reporting of scoring rubrics, rater training, and reliability checks, which would enhance the auditability of indicator-level changes. Third, the content scope could be expanded beyond rain to include additional natural phenomena that are similarly salient in children's everyday environments, such as wind, evaporation, plant growth, or simple cycles in nature, thereby testing whether the staged integration approach generalises across themes (Zahro et al., 2019; ZR & Eliza, 2020). Finally, digital extensions could be explored cautiously, not as a replacement for tangible interaction but as an enrichment that maintains developmentally appropriate engagement while broadening access and teacher support (Ayu et al., 2021; Cahyana et al., 2019).

The core design insight is that linking a familiar phenomenon to staged learning indicators through a concrete, interactive pop-up medium can strengthen early science literacy practices in settings where interactive and contextual media are limited, because teachers can implement the sequence within ordinary classroom routines while preserving children's active manipulation and guided explanation.

Conclusion

A rain-themed pop-up book that integrates three-dimensional representation with embedded activities can operationalise early science literacy as a staged progression from contact and curiosity to concept formation and concept acquisition. The contribution of this study lies in treating the pop-up book as an instructional sequence, in which each page and task is intentionally aligned with observable indicators of children's sense-making about a familiar natural phenomenon.

Feasibility evidence supports the product's readiness for classroom use. After iterative revision, expert validation reached high feasibility levels across content/material (95%), media design and durability (95.83%), and language (87.5%). Practitioner appraisal also indicated high practicality (average 95.83%), suggesting that the medium is usable within routine early childhood instruction. In the limited trial with children aged 5–6 years, aggregated observation scores increased from 49.53% to 83.79% across all indicators, indicating promising improvement in the targeted behaviours during implementation.

Interpretation of the outcome evidence should remain proportional to the study design. The trial was limited to a single setting with a small sample and relied on rubric-based observation without a comparison group; therefore, the improvement should be positioned as context-specific and suggestive rather than definitive proof of effectiveness. Future research should strengthen inference through comparative designs, report rater training and reliability checks explicitly, and test the same staged integration approach across other salient phenomena (for example, wind, evaporation, plant growth, or simple cycles in nature). Digital extensions may also be explored cautiously as an enrichment that preserves developmentally appropriate interaction and supports teacher implementation.

Declarations

Author Contribution Statement

Aip Saripudin: Conceptualization, Methodology, Investigation, Data curation, Formal analysis, Project administration, Writing – original draft. Runtah Eva Aulia: Investigation, Resources, Validation, Data curation, Writing – review & editing. Asep Mulyana: Methodology, Formal analysis, Validation, Supervision, Writing – review & editing. Diani Magasida: Validation, Visualization, Supervision, Writing – review & editing. All authors have read and agreed to the published version of the manuscript.

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Data Availability Statement

The dataset generated and analyzed during the research is available from the corresponding author upon reasonable request.

Declaration of Interests Statement

The authors declare no competing financial or personal interests.

Additional Information

No additional information is available for this paper at this time.

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