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Qualitative Inquiry into Teacher Pedagogical Strategies for Scaffolding Early Problem-Solving Skills in Indigenous Classrooms

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ABSTRACT

Despite global advancements in play-based early childhood education (ECE), a pedagogical tension persists between standardized national frameworks and localized contextual constraints in rural indigenous communities. In Tana Toraja, Indonesia, young learners often display disparities between higher-order cognitive competencies—particularly analytical problem-solving—and basic lower-order recognition skills. This study investigates teacher pedagogical strategies designed to stimulate cognitive development among learners aged 5–6, focusing on how teachers deploy scaffolding within the Zone of Proximal Development (ZPD) to navigate localized resource limitations and cultural dynamics at Hikmah Kindergarten. Adopting an exploratory qualitative case study design grounded in socio-cultural constructivism, research was conducted over a 12-week immersive fieldwork period. Data were gathered through 48 classroom observations (72 hours), semi-structured interviews with a teacher and principal, and pedagogical document analysis involving Group B learners (N=15). Using thematic synthesis, three core themes emerged: (1) cognitive skill disparity dynamics, where children excelled in rote recognition but faced bottlenecks in spatial reordering; (2) adaptive scaffolding and open-ended prompting, where teachers elevated cognitive engagement using local loose-part media and guided inquiry; and (3) contextual friction caused by rigid schedules, limited attention spans, and sparse culturally integrated apparatuses. Ultimately, fostering robust early problem-solving requires transitioning from prescriptive material usage to culturally resonant, open-ended inquiry within indigenous ECE scaffolding frameworks.

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1. INTRODUCTION

Early Childhood Education (ECE) plays a foundational role in human capital development, establishing the neural and conceptual architecture necessary for lifelong learning, adaptive executive function, and complex problem-solving (Saputri et al., 2026; Saraçoğlu & Karaoğlu, 2019; Sari et al., 2025; Sintia et al., 2025). During the

formative early childhood window (ages 3–6), rapid neuroplasticity enables young learners to construct foundational cognitive pathways through environmental exploration and social interaction (Chopra, 2025). Internationally, educational policy has increasingly prioritized play-based, inquiry-driven early learning models to cultivate lower- and higher-order cognitive domain capacities (Lamrani & Abdelwahed, 2020; Lunga et al., 2022). However, a significant gap remains between macro-level educational policies and the localized pedagogical realities of early childhood classrooms in developing and indigenous regions (Gupta, 2018; Rad et al., 2022). In many non-urban educational settings across the Global South, teachers face substantial challenges in operationalizing student-centered cognitive stimulation due to constrained educational infrastructure, standardized curricular mandates, and socio-cultural nuances that shape adult-child communication patterns (Andrade et al., 2024; Li & Ding, 2023).

The theoretical framework of early cognitive development has long been anchored in socio-cultural constructivism, notably Vygotsky's Zone of Proximal Development (ZPD) and Piaget's cognitive stage theory (Eun, 2019; Smolucha & Smolucha, 2021). Vygotsky posited that cognitive growth is inherently mediated through social interactions, language, and cultural tools, where more knowledgeable others (MKOs) provide structured guidance—termed "scaffolding" to enable learners to bridge the gap between their actual developmental level and potential problem-solving capacity (Margolis, 2020; Shabani, 2016; Smagorinsky, 2018). Modern early childhood research reinforces this view, demonstrating that cognitive stimulation is most effective when educators shift away from passive, direct instruction toward dynamic, dialogic inquiry and open-ended play (Cankaya et al., 2023; Cankaya et al., 2025; van Liempd et al., 2020; Zeng & Ng, 2025). Recent empirical literature highlights that high-quality teacher-child interactions, characterized by reflective questioning and flexible physical media (e.g., loose parts and manipulative materials), significantly enhance early executive functions, spatial reasoning, and creative problem-solving skills (Cankaya et al., 2025; Kook, 2023).

Despite these theoretical advances, a critical conceptual and empirical gap persists regarding how early childhood educators systematically scaffold cognitive development within distinct socio-cultural environments. While existing literature extensively documents early cognitive interventions in well-resourced urban settings (Fajari, 2025; Mamedova et al., 2024; Muir et al., 2023; Rodcharoen et al., 2026), less scholarly attention has been directed toward the pedagogical mechanics employed by teachers operating in culturally rich yet economically constrained rural or indigenous communities—such as Tana Toraja, South Sulawesi, Indonesia (Allo et al., 2025; Rampun et al., 2026). In such environments, educators often experience a profound tension between implementing standardized national curricula (*Indonesia's Kurikulum Merdeka PAUD*) and adapting learning environments to reflect local cultural contexts and available physical materials (Kumayas et al., 2025; Muhammad, 2026). Furthermore, empirical research frequently treats teacher strategies as monolithic constructs (simply labeling teachers as "facilitators" or "motivators") without interrogating the qualitative micro-interactions, dialogic questioning techniques, and

situational adaptations that occur when children encounter cognitive bottlenecks in real-world classrooms (Deslippe et al., 2023; Kitto et al., 2025; Stark et al., 2025).

To address this gap, this study investigates the qualitative dynamics of teacher pedagogical strategies designed to stimulate early childhood cognitive development at Hikmah Kindergarten in Tana Toraja. Specifically, this inquiry examines how early childhood educators operationalize scaffolding strategies to foster lower- and higher-order cognitive competencies among young learners (aged 5–6) in an indigenous regional context. By examining the qualitative interactions between teachers, children, and educational materials during daily instructional routines, this study addresses three central research questions:

1. How do early childhood learners display varying levels of lower- and higher-order cognitive competencies within the daily classroom setting?
2. Through what qualitative pedagogical mechanisms and scaffolding techniques do teachers stimulate cognitive problem-solving and conceptual understanding?
3. What contextual, institutional, and environmental factors support or inhibit the effective execution of cognitive stimulation in this rural educational setting?

2. METHOD

This study employed a qualitative case study design to examine the pedagogical strategies utilized by early childhood educators to stimulate cognitive development within a real-world classroom environment. A qualitative case study approach is particularly suited for exploring complex, context-dependent social phenomena where the boundaries between the phenomenon and the real-world environment are closely integrated. Grounded in socio-cultural constructivism, this design allowed for an in-depth investigation of human interactions, instructional scaffolding, and classroom dynamics without artificial manipulation.

The research was conducted at Hikmah Kindergarten, an accredited early childhood institution located in Talion Village, Rembon District, Tana Toraja Regency, South Sulawesi Province, Indonesia. Fieldwork extended over a 12-week period during the 2025/2026 academic year. Participants were selected using purposive sampling criteria to capture rich, contextually grounded pedagogical data.

The study focused on Group B (children aged 5–6 years), comprising a total cohort of 15 enrolled children (8 boys and 7 girls). Additional primary key informants included the lead classroom teacher (Teacher A, 8 years of ECE teaching experience, bachelor's degree in early childhood Teacher Education) and the school principal (Informant B, 14 years of educational leadership experience). All ethical guidelines regarding research with human subjects and young children were strictly observed; formal written informed consent was secured from the school administration and the children's parent/guardian representatives prior to data collection.

Data were gathered using three complementary qualitative collection procedures to capture classroom realities and ensure comprehensive coverage:

- Classroom Observations: The primary researcher conducted 48 non-participant and semi-participant observation sessions over 12 consecutive weeks,

accumulating over 72 hours of direct classroom field notes. Observations focused on teacher-child verbal exchanges, instructional scaffolding moments, child material exploration, puzzle/block engagement, and problem-solving behaviors during daily morning circles, structured activity blocks, and free-play sessions.

- **Semi-Structured In-Depth Interviews:** Audio-recorded, semi-structured interviews were conducted with the classroom teacher (4 sessions, averaging 45 minutes each) and the school principal (2 sessions, averaging 50 minutes each). Interview protocols explored pedagogical planning, questioning approaches, diagnostic assessment practices, institutional support structures, and perceived challenges in fostering cognitive skills.
- **Document Analysis:** Written pedagogical records were collected and analyzed, including daily lesson plans (*Rencana Pelaksanaan Pembelajaran Harian/RPPH*), child developmental observation archives, weekly assessment portfolios, and institutional context documents.

Qualitative data analysis followed the iterative thematic framework established by Miles et al. (2014), comprising data condensation, data display, and conclusion drawing/verification. Raw field notes, verbatim interview transcripts, and document notes were transcribed and imported into qualitative analysis software. Initial open coding generated an extensive codebook, which was subsequently condensed into higher-order theoretical categories related to cognitive domain indicators, scaffolding behaviors, questioning types, and structural constraints.

To establish data trustworthiness, rigor, and validation, the study employed multiple qualitative validation strategies:

- **Data Triangulation:** Triangulation was systematically conducted across sources (teacher, principal, document records) and methods (observation, interview, documentary evidence) to confirm consistency of empirical findings.
- **Member Checking:** Transcribed interview data and draft thematic interpretations were shared with the classroom teacher and principal to verify descriptive accuracy and contextual interpretation.
- **Audit Trail and Peer Debriefing:** A detailed research journal was maintained throughout the 12-week field presence to track analytical decisions, raw data coding trees, and peer debriefing reflections with senior early childhood education researchers.

3. RESULTS AND DISCUSSION

Results

Overview of Qualitative Findings

Systematic thematic analysis of classroom observations, interview transcripts, and pedagogical documents revealed three central empirical findings concerning cognitive stimulation at Hikmah Kindergarten: (1) an observational distinction between basic recognition skills and complex problem-solving capabilities; (2) specific qualitative scaffolding mechanisms deployed by the teacher to foster cognitive engagement; and

(3) an interplay of contextual facilitators and environmental friction affecting daily instruction.

Cognitive Disparity: Lower-Order vs. Higher-Order Performance

Classroom observations revealed a clear distinction in children's cognitive engagement across different types of tasks. During structured learning sessions, learners demonstrated high competence in lower-order cognitive tasks (color identification, basic geometric shape recognition, and simple 1-to-1 matching). However, when confronted with tasks requiring higher-order cognitive processing—such as spatial reordering, open-ended block construction, and multi-step logic puzzles—learners frequently exhibited cognitive hesitation and reliance on adult direction. Fieldwork observations captured these contrasting developmental behaviors across various learning domains, as summarized in Table 1.

Table 1. Qualitative Observation of Early Cognitive Competency Indicators in Group B (N=15)

Cognitive Skill Domain	Observed Learner Behavior & Interaction Patterns	Developmental Qualitative Classification
Color & Shape Recognition	Children rapidly identify primary colors and basic shapes (circle, square, triangle) with minimal hesitation during group flashcard or sorting activities.	High Mastery (Lower-Order Cognitive)
1-to-1 Object Matching	Learners seamlessly pair identical visual images or corresponding object cards using concrete manipulative sets.	High Mastery (Lower-Order Cognitive)
Attribute Sorting (Color/Size)	Children group loose plastic counter beads by a single attribute (e.g., color) effortlessly, but struggle when required to sort simultaneously by two attributes (e.g., color and size).	Moderate Mastery (Mid-Tier Cognitive)
Rote Counting & Quantification (1–10)	Learners recite number sequences 1–10 accurately in unison, though approximately one-fifth of the cohort demonstrates minor errors when associating abstract numerals with physical quantities exceeding 7 items.	Moderate Mastery (Mid-Tier Cognitive)
Spatial Puzzle Assembly	When working with 12-to-15-piece spatial jigsaw puzzles, several children resort to trial-and-error force fitting rather than analyzing spatial contours or image boundaries.	Emerging / Bottleneck (Higher-Order Cognitive)
Analytical Problem-Solving	When presented with open-ended spatial challenges (e.g., building a stable bridge structure out of wooden blocks), learners frequently seek immediate teacher verification rather than testing independent structural strategies.	Emerging / Bottleneck (Higher-Order Cognitive)

Based on the empirical qualitative observations detailed in Table 1, the cognitive landscape of early learners in Group B ($N = 15$) reveals a pronounced developmental dichotomy between foundational cognitive mechanics and higher-order reasoning faculties. On one hand, basic lower-order cognitive processes—specifically *Color & Shape Recognition* and *1-to-1 Object Matching*—demonstrate high levels of mastery,

as evidenced by the children's fluent identification of primary shapes and seamless pairing of visual manipulatives. These foundational abilities align with Piagetian preoperational frameworks, indicating well-consolidated perceptual schemata and robust rote memory capacities. However, as cognitive demands transition toward mid-tier processes like *Attribute Sorting* and *Rote Counting & Quantification (1–10)*, operational friction emerges. While single-attribute classification (e.g., color) is executed effortlessly, dual-variable logic (sorting simultaneously by color and size) presents a structural challenge. Similarly, while visual-auditory enumeration (1–10) is well-ingrained, abstract visual-to-quantity cardinal alignment breaks down when quantities exceed seven. This transition highlights a crucial developmental threshold where symbolic representation and working memory capacity begin to constrain unassisted task execution.

Crucially, complex cognitive operations—namely *Spatial Puzzle Assembly* and *Analytical Problem-Solving*—represent significant developmental bottlenecks, remaining largely at an emerging stage. When confronted with non-routine spatial tasks (12–15-piece puzzles) or open-ended structural challenges (building stable wooden bridges), learners predominantly default to lower-level trial-and-error behaviors, force-fitting pieces, or seeking immediate adult verification rather than formulating hypotheses or analyzing spatial boundaries independently. This dependency behavior suggests that while the children possess basic executive control, their metacognitive strategies and self-regulatory problem-solving mechanisms are insufficient for high-order spatial synthesis. From a Vygotskian sociocultural perspective, these higher-order domains fall precisely within the children's Zone of Proximal Development (ZPD). Rather than indicating cognitive deficit, these patterns underscore an urgent need for targeted instructional scaffolding, guided metacognitive prompting, and structured spatial manipulatives to help young learners transition from external instructional dependency toward autonomous, higher-order analytical reasoning.

Scaffolding Mechanics and Dialogic Prompting

Observational data demonstrated that the lead teacher employed specific pedagogical techniques to transition children from passive instruction to active cognitive exploration. Rather than directly supplying answers when children encountered task difficulties, the teacher utilized open-ended prompting and gradual physical support to maintain children within their Zone of Proximal Development. A representative observational vignette illustrates this interactive scaffolding process during a spatial construction activity:

Classroom Observation Vignette 04 (Week 5, Block Area):

Child C (5 years, 4 months) attempts to construct an archway using wooden blocks, but the top horizontal piece continually falls. Frustrated, Child C looks toward the teacher and says, "*Bu, ini tidak bisa berdiri, kapok meledak terus!*" (*Teacher, this won't stand, it keeps collapsing!*).

Instead of placing the block correctly for the child, Teacher A kneels at eye level and points to the two vertical support pillars.

Teacher A: "Coba anakku perhatikan dua tiang di bawah ini. Apakah jarak tiang kiri dan kanan sudah sama lebarnya dengan balok yang di atas?" (My child, look at these two pillars below. Is the distance between the left and right pillars as wide as the block on top?)

Child C: (Pauses, examines the gap, and moves the right pillar closer). "Ah, terlalu jauh tadi, Bu!" (Ah, it was too far apart before, Teacher!)

Teacher A: "Nah, sekarang kalau ditaruh kayu yang panjang di atasnya, apa yang terjadi?" (Now, if you put the long wood on top, what happens?)

Child C carefully positions the top block, which remains stable, and smiles. The teacher reinforces the discovery: *"Pintar! Jadi kalau mau tiangnya kuat, alasnya harus diukur dulu ya." (Clever! So if you want strong pillars, the base must be measured first.)*

This qualitative interaction highlights how the teacher's deliberate shift from direct intervention to reflective questioning encouraged the child to analyze structural spatial relationships independently, transforming a moment of frustration into an opportunity for cognitive skill building.

Contextual Facilitators and Environmental Friction

In-depth interviews with Teacher A and the School Principal revealed a complex dynamic between supporting factors and operational constraints in delivering daily cognitive stimulation.

Section 1: Supporting Factors in Daily Cognitive Stimulation

Researcher: Good morning. Thank you both for agreeing to this in-depth session. To begin, could you explain how you deliver daily cognitive stimulation despite the resource challenges in your context?

Teacher-A: "Well, we cannot rely on expensive, commercial educational software or digital tools here, they are simply out of reach for us financially. Instead, we heavily integrate local loose parts into our curriculum. We collect wooden blocks, local plant seeds, dried coconut shells, and clean recycled containers."

Researcher: How do these natural and recycled materials support cognitive tasks in practice?

Teacher-A: "They act as powerful manipulative materials. For instance, when we teach early numeracy or classification, seeds and coconut shells serve as counters and sorting tools. Children build spatial patterns with wooden blocks. Because these items are open-ended, children naturally experiment more. It compensates for the lack of digital apparatuses."

Researcher: [Turns to Principal] How does the school administration support these localized adaptations?

School Principal: *"My role is to remove bureaucratic rigidity from the classroom floor. I explicitly encourage our teaching staff to adapt their daily lesson plans dynamically based on real-time observations of child interest. If Teacher A sees that children are hyper-engaged in a spatial building task using loose parts, she has full administrative backing to extend that cognitive activity rather than strictly sticking to a rigid time block."*

Section 2: Environmental And Structural Constraints

Researcher: *Despite these facilitators, what are the primary structural or behavioral constraints you observe during these cognitive sessions?*

Teacher-A: *[Sighs lightly] "The first major challenge is managing short attention spans and emotional regulation in early learners. During structured cognitive tasks—like early logic or pattern recognition—children frequently exhibit rapid shifts in focus. A task that lasts more than 10 minutes often leads to restlessness."*

Researcher: *How do you navigate those rapid shifts?*

Teacher-A: *"It requires continuous activity variation. I have to pivot quickly—switching from individual sorting to a movement-based spatial task—to keep them cognitively engaged before they lose emotional regulation."*

Researcher: *What about material limitations beyond loose parts?*

School Principal: *"While loose parts are fantastic, they have clear boundaries. We lack complex, durable spatial apparatuses and specialized early STEM tools—such as precision geometry sets, balance scales, or basic scientific observation kits. loose parts foster creativity, but higher-order structural reasoning sometimes requires specialized apparatuses that we just don't possess."*

Section 3: Administrative Tensions and Daily Routines

Researcher: *Is there any tension between instructional flexibility and administrative obligations?*

Teacher-A: *"Yes, absolutely. The most frustrating issue is rigid scheduling tensions. We are required to adhere to daily administrative reporting routines—documenting attendance, filing progress checklists, and updating regulatory logs."*

Researcher: *How does that report burden impact child-led learning?*

Teacher-A: *"It occasionally truncates child-led, open-ended exploration sessions. Just as a group of children hit a breakthrough in an open-ended problem-solving activity, I am forced to interrupt and transition them prematurely to the next lesson component so I can fulfill the daily administrative checklist on time."*

School Principal: *"It is a delicate balancing act. As an administrator, I need those reports for compliance and school governance, but I acknowledge that these routines sometimes disrupt the natural flow of deep cognitive exploration."*

Supporting Factors: Key facilitators included the strategic integration of locally sourced manipulative materials (e.g., wooden blocks, seeds, coconut shells, and recycled containers used as loose parts) which compensated for limited commercial educational software. Additionally, strong administrative support from the school

principal encouraged teachers to adapt lesson plans flexibly based on observable child interests.

Environmental and Structural Constraints: Conversely, three primary constraints were identified during fieldwork:

- Short Attention Spans & Emotional Regulation: Young learners frequently exhibited rapid shifts in focus during structured cognitive tasks, requiring continuous activity variation.
- Material Limitations: While local loose parts were utilized effectively, the school lacked sufficient complex, durable spatial apparatuses and specialized early STEM tools.
- Rigid Scheduling Tensions: The necessity to adhere to daily administrative reporting routines occasionally truncated child-led, open-ended exploration sessions, forcing teachers to transition prematurely to subsequent lesson components.

Discussion

Benchmarking Findings Against Global ECE Literature

The findings of this study offer important insights into how early childhood educators scaffold cognitive development within resource-constrained, non-urban educational contexts. Consistent with Vygotsky's socio-cultural constructivism and Piagetian cognitive theories, our observations confirm that young children build conceptual understanding through hands-on interaction with physical objects and mediated dialogue (Rubtsov, 2020; Smolucha & Smolucha, 2021). However, while classical literature often assumes a uniform progression through developmental stages, our findings reveal a distinct cognitive disparity (Dasen, 2022; Maidansky, 2021): children demonstrated high proficiency in lower-order recognition tasks (shape and color identification) but encountered substantial friction when navigating higher-order problem-solving tasks (spatial reasoning and multi-attribute classification).

This observed disparity aligns with recent international empirical studies highlighting that early childhood environments in developing regions often over-emphasize rote learning and structural recall at the expense of higher-order executive function cultivation (Blair, 2016; Obradović & Willoughby, 2019). While learners in this study easily mastered single-variable sorting, multi-variable logic required continuous teacher mediation. This finding underscores the necessity of moving beyond traditional, static early childhood assessments that treat cognitive capability as a singular metric, advocating instead for dynamic assessments that measure a child's response to instructional scaffolding.

The Mechanics of Teacher Scaffolding and Dialogic Questioning

A primary theoretical contribution of this study lies in illustrating the qualitative micro-mechanisms of effective early childhood scaffolding. Rather than providing direct answers, the observed educator utilized reflective, open-ended dialogic questioning to shift children from frustration to structural analysis. This aligns with

recent work on early executive function development, which demonstrates that open-ended teacher questioning ("What happens if...?" or "Why do you think...?") prompts metacognitive reflection, encouraging children to test hypotheses independently (Vezzani, 2019).

Furthermore, the creative deployment of locally sourced loose parts (e.g., coconut shells, wooden offcuts, and natural seeds) served as an effective substitute for commercial educational technologies. This finding supports growing international evidence that low-cost, open-ended natural materials can offer richer spatial and tactile cognitive stimulation than highly structured, single-purpose commercial toys (Johnstone et al., 2022; Parsons, 2019). By encouraging children to reconfigure loose materials flexibly, educators foster adaptive problem-solving capacities that are deeply embedded in the child's immediate physical environment (Cankaya et al., 2023; Spencer et al., 2021).

Addressing Structural Constraints in Indigenous Contexts

Despite the positive scaffolding practices observed, this study identifies significant structural friction that impedes optimal cognitive stimulation. The tension between administrative scheduling requirements and child-led exploration play remains a ubiquitous challenge in early childhood education globally. When teachers are constrained by rigid temporal frameworks, they are often forced to truncate child exploration, inadvertently curtailing the very problem-solving processes that nurture higher-order thinking.

To mitigate these constraints, early childhood policy must prioritize pedagogical flexibility over rigid administrative metrics (Hayes, N., & Filipović, 2018; Peltoperä et al., 2023; Weimann-Sandig & Duderstadt, 2026). In rural and indigenous settings such as Tana Toraja, professional development initiatives should focus on equipping educators with actionable scaffolding techniques that seamlessly integrate local cultural artifacts and open-ended play into daily instruction. By aligning macro-level educational mandates with localized classroom realities, early childhood systems can better support holistic cognitive growth in young learners.

4. CONCLUSION

This qualitative study examined the pedagogical strategies used by early childhood educators to stimulate cognitive development among young learners at Hikmah Kindergarten in Tana Toraja. The findings reveal a clear developmental distinction between basic lower-order cognitive competencies—such as color, shape, and object recognition—and emerging higher-order problem-solving skills, which require active instructional scaffolding. Through open-ended dialogic questioning, adaptive guidance within the Zone of Proximal Development, and the creative use of local loose-part materials, the classroom teacher successfully transformed cognitive challenges into meaningful learning experiences. However, operational constraints—including short attention spans, material limitations, and rigid instructional schedules—continue to present ongoing challenges for classroom execution.

Theoretical and practical insights from this study extend socio-cultural constructivist literature by demonstrating that teacher scaffolding within rural, non-urban early childhood settings is most potent when pairing dialogic questioning with flexible, open-ended physical materials and culturally responsive frameworks. Practically, early childhood educators must transition from directive instruction to reflective questioning while leveraging locally accessible loose parts to foster spatial and logical reasoning without relying on expensive commercial apparatuses. Concurrently, educational administrators and policymakers should institutionalize specialized professional development on dynamic cognitive assessment while revising rigid schedules to facilitate child-led exploratory problem-solving. While the contextual depth of this single-site case study involving 15 learners in Tana Toraja offers rich empirical detail, it inherently bounds statistical generalizability; consequently, future research should implement multi-site, longitudinal qualitative inquiries across diverse indigenous contexts and incorporate mixed-method designs to track the long-term trajectories of culturally mediated scaffolding on executive function and academic readiness.

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