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FORMATION OF EARLY CHILDREN'S MATHEMATICAL THINKING IN STORYTELLING ACTIVITIES IN PRESCHOOL: A PRELIMINARY STUDY IN DHARMA WANITA KINDERGARTEN, BENGKULU CITY

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Abstract

Mathematical thinking in early childhood is not merely the ability to recognize numbers, but a process of understanding relationships, patterns, and structures within everyday experience. This article reports a preliminary study aimed at identifying early indications of the emergence of young children's mathematical thinking during storytelling activities at TK Dharma Wanita, Bengkulu City, a kindergarten with a routine storytelling program called "Morning Bercerita". A qualitative descriptive approach was used through participatory observation and unstructured interviews with classroom teachers during the pre-research period of 12 January–13 April 2026. The preliminary findings identified three early indications: (1) children showed more active thinking—predicting, comparing, and explaining reasons—during dialogic storytelling compared with instructional activities; (2) repeated actions and cause–effect relationships within story plots become contexts that triggered children's reasoning; and (3) storytelling in this school functions as a distinctive activity setting due to its routine, interactive, and media-rich implementation. These preliminary indications affirm storytelling as a promising natural context for the emergence of mathematical thinking and provide the conceptual and methodological grounding for a subsequent case study to be conducted in July–August 2026.

Keywords: Mathematical Thinking; Early Childhood; Storytelling; Activity Settings; Preliminary Study.

INTRODUCTION

Mathematical thinking in early childhood forms a cognitive foundation that supports long-term academic readiness and plays a role in the development of reasoning and problem-solving skills in various life contexts. From a contemporary perspective, mathematical thinking is understood as the process of identifying patterns, building relationships, and generalizing experiences, rather than simply mastering symbols or procedures (Almulhim & Fujita, 2026). Björklund, van den Heuvel-Panhuizen, and Kullberg (2020) emphasize that the essence of mathematical thinking lies in the process of constructing meaning through concrete experiences and social interactions, rather than in formal mastery of mathematical content.

Initial observations conducted by researchers at Dharma Wanita Kindergarten in Bengkulu City revealed an interesting phenomenon that warrants further study. This school has a strong storytelling culture through its routine "Morning Storytelling" program, held every morning for approximately 5–7 minutes before class begins. Unlike instructional activities, where children tend to follow the steps as directed by the teacher, children were much more active in making predictions, comparing situations, and explaining relationships between events when engaged in dialogic storytelling. These responses indicate the process of reasoning and organizing relationships that are part of early childhood mathematical thinking. Several previous studies have demonstrated the link between narrative activities and children's reasoning development. Russo, Russo, and Bragg (2021) explain that narrative structures containing sequences of events and cause-and-effect relationships can support children's logical reasoning contextually. Li and Disney (2023) show that dialogue in storytelling activities helps children develop reflective processes, while Björklund et al. (2020) emphasized that early childhood mathematical understanding develops more optimally when learning is integrated with language and contextual experiences. However, most of these studies still position storytelling as a mathematics learning strategy or as a medium to support language development. Consequently, studies specifically examining how early childhood mathematical thinking emerges naturally in

everyday storytelling activities—particularly in the context of early childhood education in Indonesia—are still relatively limited. Based on this gap, this article reports the results of a preliminary study conducted as a pre-research stage before the researcher conducted a more in-depth case study. This preliminary study aimed to: (1) capture early indications of the emergence of early childhood mathematical thinking during storytelling activities, and (2) map the characteristics of storytelling activities at Dharma Wanita Kindergarten in Bengkulu City as a context that has the potential to facilitate the emergence of mathematical thinking. The results of this preliminary study were then used to sharpen the focus, sub-focus, and research instruments in the follow-up case study.

Theoretically, this article is expected to provide an initial contribution to the study of cognitive psychology and early childhood education, particularly in understanding mathematical thinking through a narrative approach that is contextual, rather than formal-procedural. Practically, the results of this preliminary study can serve as an initial reference for early childhood education teachers in optimizing storytelling activities—which have so far been more directed at moral and language development—as a space that also stimulates children's mathematical reasoning. Therefore, this preliminary study report is not intended to generalize the findings, but rather to provide a sufficiently rich initial picture as a basis for designing the main research.

LITERATURE REVIEW

Mathematical Thinking in Early Childhood

Mathematical thinking in early childhood is not limited to the ability to recognize number symbols, but also includes the ability to understand relationships between objects, recognize patterns and regularities, and interpret changes in situations logically (Björklund et al., 2020). Mulligan and Mitchelmore (2013), through their Awareness of Mathematical Pattern and Structure theory, explain that the core of mathematical thinking lies in children's sensitivity to recognizing patterns and structures in various situations. In line with this, Mason, Burton, and Stacey (2010) view mathematical thinking as a process that occurs through three stages: seeing (recognizing important information from a situation), sticking (facing uncertainty that encourages the search for relationships), and convincing (developing conjectures and providing reasons). This framework is relevant to understanding how children process information in a storyline—from recognizing events, questioning their continuation, to explaining the reasons behind their answers.

Storytelling Activities as Activity Setting

From a sociocultural perspective, storytelling can be understood as an activity setting, a social context that allows children to construct understanding through interaction and language use (Rogoff, 2003; Fleer, 2011). Vygotsky (1978) emphasized that children's mental functions first emerge in social interactions before becoming internal individual abilities. Story structures, which include sequences of events, repetition of actions, and cause-and-effect relationships, provide a framework that aligns with the logical structure of mathematics (Russo et al., 2021). Interactive storytelling—through interactive read-aloud and story retelling techniques—provides space for children to predict, interpret, and engage in reflective dialogue (Whitehurst et al., 1988; Isbell & Raines, 2013), thus potentially serving as a medium for stimulating children's mathematical thinking contextually.

METHOD

This study is a preliminary study conducted as part of the pre-research phase prior to a more in-depth case study. Unlike the main case study, this preliminary study is not intended to produce conclusive conclusions, but rather to gather initial indications and sharpen the research focus through a descriptive qualitative approach.

The study was conducted at Dharma Wanita Persatuan Kindergarten of Bengkulu Province, located on Jl. Lingkar Timur, Singaran Pati, Bengkulu City, during the pre-research period of January 12–April 13, 2026. This location was chosen purposively because the school has a strong storytelling culture through the “Pagi Bercerita” program which is held routinely every morning. The subjects of observation at this stage were children in Kindergarten B (aged 5–6 years) along with the Kindergarten B1 and B2 class teachers as supporting informants. Data were collected through two main techniques. First, participatory observation with the researcher as observer-as-participant, that is, being directly present in learning activities without taking on the role of teacher, in order to maintain the naturalness of the learning situation (Creswell & Poth, 2018). Second, unstructured interviews (in-depth interviews) with class teachers and the principal to obtain an overview of the implementation of storytelling activities, the use of media, and teachers' views on children's thinking involvement. Data were recorded through field notes and supported by photo documentation of activities.

Data analysis in the preliminary study phase was conducted descriptively through simple thematic grouping (open coding), namely by repeatedly reading field notes to identify patterns of children's responses that indicate mathematical thinking, then relating them to the characteristics of the storytelling activity implementation. The results of the grouping were informally cross-checked with teacher statements in interviews to strengthen the reasonableness of the initial interpretation. It should be emphasized that this preliminary study has limited scope and has not implemented the full triangulation procedures and data validity checks as will be done in the main case study.

RESULTS AND DISCUSSION

Indications of the Emergence of Mathematical Thinking in Children's Responses

During the storytelling activity, children exhibited several responses that indicated mathematical thinking. They appeared to recognize the repetition of actions performed by the characters, understood the relationship between actions and their consequences, compared the characteristics or conditions of objects encountered by the characters, and followed the problem-solving process as the characters tried various methods until they found a solution. These abilities did not emerge through counting or symbol recognition, but rather through the children's involvement in understanding the sequence of events and storyline—in line with the findings of Björklund et al. (2020) that children's mathematical understanding develops through contextual and meaningful experiences.

Storytelling Activities as a Facilitating Context

The implementation of "Morning Storytelling" at Dharma Wanita Kindergarten in Bengkulu City demonstrates the unique characteristics of an activity setting. The teacher does not simply read the story, but pauses the reading at certain points to ask questions that encourage children to think, such as asking why a character has not succeeded or possible next actions. The use of a variety of media—picture books, hand puppets, and big books—helps children connect visual representations with the storyline (Nikolajeva & Scott, 2013). These characteristics reinforce the views of Fleer (2011) and Rogoff (2003) that an activity setting provides the conditions for children's participation and construction of meaning through repeated and culturally structured social interactions.

Differences in Responses to Instructional and Dialogic Activities

The findings of this preliminary study also show a clear difference between children's responses to instruction-dominated activities and dialogic storytelling activities. In instructional activities, children tended to follow the steps and complete tasks as directed without much initiative in asking questions or making predictions. In contrast, in dialogic storytelling activities, children were more active in making assumptions, explaining reasons, and connecting the story to their personal experiences. This pattern is consistent with the findings of Green, Piel, and Flowers (2018) that interactive storytelling can improve children's ability to understand relationships and recognize patterns compared to purely symbolic learning.

These three initial indications provide sufficient empirical basis to confirm that storytelling activities at Dharma Wanita Kindergarten in Bengkulu City have the potential to become a natural space for the emergence of mathematical thinking in early childhood. However, because this preliminary study is limited and has not explored the gradual process of the emergence of mathematical thinking, further studies are needed that use the seeing–sticking–convincing process framework from Mason et al. (2010) to understand how these stages of thinking are formed during storytelling interactions, as well as the activity setting framework to analyze more deeply the role of social interaction and cultural tools in this process.

Summary of Preliminary Study Findings

In summary, the three initial indications along with examples of responses observed during the pre-research period are presented in Table 1 below.

Table 1. Summary of Initial Indications of the Preliminary Study

Indication	Description Short	Example Response/Characteristics	Data source
Introduction pattern & repetition	Child recognize repetition the character's actions in an effort to achieve goals	Mentioning "try it Again" moment the character repeats the effort	Observation
Connection cause and effect	Child understand relatedness between actions and consequences in a story	Explain reason something incident happened in the story	Observations, field notes

Prediction & solving problem	Child estimate continuation story and method figure solve the problem	Answer question predictive Teacher spontaneously	Observation, teacher interviews
Simple comparison	Child compare characteristics of characters, objects, or situations	Compare size/property figure in the story	Observation, documentation
Activity storytelling setting	Program "Morning Tell a story" routine, dialogic, and varied media	Teacher stop reading For ask; use of picture books & dolls	Interviews, documentation

Implications for Further Case Study Design

The findings of this preliminary study provide several methodological implications for further case study research. First, the observational focus in the primary study needs to be more specifically directed at dialogic moments in storytelling activities, as these moments are the ones that most often elicit indications of mathematical thinking. Second, the teacher interview guide needs to include more in-depth questions regarding teachers' strategies for designing predictive and reflective questions, given that the quality of teachers' questions appears to influence the intensity of children's responses. Third, visual documentation and audio recordings need to be strengthened in the primary study to capture nuances of verbal interactions that were not fully captured through field notes in this preliminary stage. These three implications align with the principles of emergent qualitative research, where research procedures are developed and adjusted based on emerging findings in the field (Creswell & Poth, 2018).

CONCLUSION

This preliminary study identified three early indicators that are relevant for further study: children's more active involvement in dialogic storytelling activities, the role of narrative structures (repetition, cause-and-effect) as triggers for reasoning, and the characteristics of the "Pagi Bercerita" activity as an activity setting that supports children's regular and interactive participation. These findings reinforce the assumption that storytelling activities are not merely literacy activities, but also provide a space for the natural emergence of mathematical thinking in early childhood.

The results of this preliminary study serve as a conceptual and methodological basis for further case study research to be conducted in July–August 2026 in the Kindergarten B1 and B2 groups of Dharma Wanita Kindergarten, Bengkulu City, using a qualitative case study approach, Mason's thinking process framework (seeing–sticking–convincing), and a sociocultural perspective on activity settings and cultural tools to understand more deeply how early childhood mathematical thinking emerges in storytelling activities in PAUD.

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