Preschoolers' Cognitive Profiles on Environmental Cleanliness: A Piagetian-Based Thematic Assessment of 6-Year-Olds

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ABSTRACT

Environmental cleanliness is a socially relevant yet underexplored theme in early childhood cognitive development. While preschool education often introduces hygiene routines, little is known about how young children cognitively construct meaning around cleanliness. Most studies have focused on abstract academic domains like literacy and numeracy, while real-world issues remain marginal despite their potential to stimulate rich cognitive processes. This study investigates the cognitive profiles of six-year-old children on the theme of environmental cleanliness, grounded in Piaget's theory of the preoperational stage. It explores how children demonstrate development across four domains including symbolic thinking, memory, language use, and imagination. A thematic assessment instrument was developed and validated through expert review, comprising 13 observable indicators. Data were collected through structured observation and guided interviews with seven children in three kindergartens in Medan, Indonesia. Findings revealed that most participants were categorized as *established* in memory and language use, indicating strong recall and verbal explanation of cleanliness routines. However, symbolic thinking and imagination remained in the *developing* range, particularly in tasks involving abstraction or causal reasoning. These results highlight the importance of contextualized, thematic assessment in revealing nuanced developmental patterns and underscore the need to foster symbolic and imaginative reasoning as part of early environmental education.

1.   INTRODUCTION

Understanding and monitoring cognitive development in early childhood is fundamental to fostering a strong foundation for lifelong learning, behavior, and well-being. Cognitive development influences how children think, explore, and figure things out forming the basis of their problem-solving, decision-making, and conceptual understanding (Knowles, 2023; Qin et al., 2025; Roslan et al., 2022). During the preschool years, children begin to organize their thoughts and experiences more systematically, which in turn affects how they interact with their physical and social environments (Alwaely et al., 2021; Evans, 2021; Meagher, 2020). Given the critical role that early cognition plays in shaping children's future learning trajectories, it becomes imperative to assess their cognitive profiles in contexts that are both meaningful and developmentally appropriate (Engler & Alfonso, 2020; Kamber et al., 2023; Qin et al., 2025). One of the most influential frameworks for understanding early cognitive development is Jean Piaget (1951) theory of cognitive stages. According to Piaget, 6-year-old children typically function within the preoperational stage, which spans approximately from ages 2 to 7. This stage is characterized by rapid development in symbolic thinking, where children learn to use words, images, and objects to represent something not physically present (Gerosa et al., 2021; Scalise & Ramani, 2021). Additionally, preoperational children demonstrate increased memory capacity, expanding language use, and vivid imagination (Kit et al., 2024; Pelaez & Monlux, 2020). However, their thinking remains egocentric and intuitive, often lacking the logical operations seen in older children. Other theorists, such as Vygotsky (1978), emphasize the social nature of cognition, highlighting how language and interaction with adults scaffold children's learning. Taken together, these perspectives point to the richness and complexity of cognitive functioning at this age making it a crucial period for assessment.

Recent research on cognitive development during the preoperational stage has utilized a variety of tools and contexts to examine how young children think, remember, and communicate. Language-based storytelling (Nguyen, 2021; Too Small to Fail, 2024) and pretend play assessments (Doernberg et al., 2021; Francis & Gibson, 2023; Kızıldere et al., 2020; Russ, 2021) have been particularly effective in capturing symbolic thinking and imagination, core features of this developmental period. Performance-based tasks, such as block design, picture categorization, and analogical reasoning have also been used to assess causal thinking and memory recall (Akhavan Tafti et al., 2023; Cottini et al., 2021; Georgiou & Zhang, 2023; Wigglesworth & Frost, 2017). In literacy and numeracy domains, studies have often employed storybook-based assessments and digital games to examine cognitive flexibility and emergent reasoning (Cowan & Flewitt, 2023; Duan et al., 2024; Gashaj et al., 2025; Swirbul et al., 2024). These tasks are usually conducted in controlled settings like classrooms or laboratories, allowing researchers to isolate variables but sometimes lacking contextual authenticity. Moreover, researchers have explored the relationship between children's executive function and their cognitive representation through structured observation and task completion (Howard & Vasseleu, 2020; Moriguchi, 2014; White & Carlson, 2021), while others have focused on metacognitive awareness through dialogic interviews and child-led explanation tasks (Marulis & Nelson, 2021; Rivas et al., 2022). Although these studies have significantly contributed to our understanding of cognitive processes in early childhood, most have been centered on abstract or academic domains such as mathematics, phonological awareness, or

working memory. Comparatively few studies have examined how preoperational cognitive domains emerge and interact within socially meaningful and ecologically valid themes such as environmental cleanliness, sustainability, or health. For example, while some environmental education studies have evaluated children's awareness of recycling or pollution (Collado & Evans, 2023; Friman et al., 2024; HALEK et al., 2021; Kahriman-Pamuk & Pramling Samuelsson, 2024; Meagher, 2020; Samuelsson, 2021), they often treat knowledge as a static outcome rather than examining the underlying cognitive mechanisms through which children understand environmental concepts. There remains a critical need for research that bridges the gap between developmental psychology and environmental themes by assessing how children *construct* their understanding of real-world issues using the tools of memory, language, symbolic representation, and imagination (Akhavan Tafti et al., 2023; Cottini et al., 2021; Francis & Gibson, 2023; Gerosa et al., 2021; Kızıldere et al., 2020; Scalise & Ramani, 2021; Torras Vila, 2021; White & Carlson, 2021).

In this study, we propose the theme of environmental cleanliness as a rich and authentic context for assessing cognitive development in preschoolers. Environmental cleanliness is a tangible and observable concept for young children, often reflected in their daily routines, such as disposing of waste, recognizing cleanliness tools, or commenting on dirty versus clean surroundings. By embedding assessment in this theme, we can gain insight into how children symbolically represent environmental concepts, recall relevant experiences, use language to describe observations, and imagine consequences of environmental neglect. This thematic approach not only aligns with children's lived experiences but also adds ecological validity to the assessment process. Furthermore, fostering environmental responsibility in early childhood requires more than instilling habits, it involves nurturing cognitive awareness and moral reasoning (Collado & Evans, 2023; Sun et al., 2020). Behaviors such as not littering, separating waste, or using cleaning tools appropriately stem from a child's understanding of cause-effect relationships, function recognition, and symbolic associations (Kavaz et al., 2021; Rothstein et al., 2021). Thus, character traits like environmental caring and cleanliness are deeply rooted in early cognitive processing (Nawaz et al., 2024; Nobre et al., 2023; Salahodjaev, 2018). Before such behaviors become habitual or value-driven, they must be cognitively constructed and understood. Therefore, assessing preschoolers' cognitive development within the domain of environmental cleanliness offers a dual advantage which it serves as a diagnostic lens into their cognitive stage while also allowing us to forecast their potential for environmental awareness and responsibility. Despite increasing attention to environmental education in early childhood, limited research has systematically examined how cognitive domains, particularly those delineated in Piaget's preoperational stage, are activated through cleanliness-related themes. This study addresses that gap by offering a theoretically grounded and developmentally appropriate assessment framework.

The present study aims to (1) describe preschoolers' cognitive profiles regarding environmental cleanliness using indicators aligned with the four core cognitive domains in Piaget's preoperational stage including symbolic thinking, memory, language use, and imagination; and (2) identify which domains show relative strength and which require further support or enhancement. The thematic tasks were designed not as evaluative tests, but as playful, situated activities that allow children to express and construct their understanding, making this study an instance of assessment as learning, where assessment itself becomes a tool for meaning-making rather than mere measurement. Using this approach, we interpret

children's responses through the lens of Piagetian theory to ensure that developmental stages are adequately captured and meaningfully contextualized. Ultimately, this study contributes to the growing discourse on contextualized cognitive assessment in early childhood education. By situating our analysis within the Piagetian framework and applying it to a socially relevant theme, we hope to provide educators and researchers with valuable insights into how young children think about and relate to their environment and how this shapes their potential for lifelong environmental stewardship.

2. METHODOLOGY

This study employed a quantitative descriptive approach to examine how six-year-old children demonstrate cognitive abilities related to environmental cleanliness, with a specific focus on four core domains of the preoperational stage as outlined by Piaget, including symbolic thinking, language use, memory, and imagination (Creswell & Poth, 2018). The assessment was conducted through observation and semi-structured interviews, which were selected due to their appropriateness for capturing the natural expressions and representations of young children. Observational methods allow researchers to witness children's spontaneous behaviors and actions in context, while interviews, when guided through play-based or image-supported prompts offer, access to the verbal and imaginative dimensions of children's thinking (Creswell, 2013). These two techniques complement each other by providing both behavioral and verbal data, enriching the interpretation of each child's cognitive profile. Given the developmental characteristics of six-year-olds, the methods employed in this study were carefully adapted to ensure comfort, authenticity, and reliability. The observation sessions took place during natural play and learning routines at school, ensuring minimal disruption and promoting ecological validity. Interviews were designed as interactive dialogues, often accompanied by illustrated prompts depicting clean and dirty environments, everyday objects, or cleaning tools, to stimulate symbolic associations and facilitate verbal expression. In line with ethical research involving young children, the researcher maintained a non-intrusive presence, and all interactions were conducted in a child-friendly manner to support open communication and reduce performance anxiety.

In order to guide the observation and interview process, a structured rating scale instrument was developed based on a detailed indicator framework aligned with Piagetian theory. The instrument included a grid (blueprint) of cognitive skills organized across four domains including symbolic thinking, language use, memory, and imagination, each contextualized within the theme of environmental cleanliness. For example, indicators under symbolic thinking included the ability to recognize symbolic representations of dirt or cleaning tools in images; memory-related indicators assessed whether children could recall past experiences related to cleanliness; language use focused on the clarity and relevance of verbal descriptions, while imagination was explored through children's hypothetical explanations of consequences or envisioned solutions for unclean environments. The development of this instrument itself followed several iterative stages. First, the researcher conducted a content analysis of existing developmental indicators for the target age group, identifying relevant cognitive benchmarks within the preoperational stage. Second, the theme of environmental cleanliness was selected based on its contextual relevance, accessibility to young children, and potential to elicit cognitive engagement. Third, observable behavioral descriptors were formulated for each domain, ensuring alignment with both theoretical constructs and real-life

scenarios children might encounter. Each indicator was then scored using a three-point rating scale, 1 for *emerging*, 2 for *developing*, and 3 for *established.* This scale was designed to capture the continuum of developmental progress rather than a binary measure of ability.

The draft instrument was then reviewed and validated by two experts, one in developmental psychology and another in educational assessment (Schonert-Reichl et al., 2013). The developmental psychologist evaluated the content validity of the indicators and descriptors, ensuring their alignment with Piaget's theoretical constructs and their appropriateness for six-year-olds. Meanwhile, the assessment expert provided input on the construct validity of the scale itself, including the clarity of rubric language, scoring reliability, and alignment between indicators and observable behavior. The final instrument consisted of *13 skill items* distributed across four cognitive domains including symbolic thinking, language use, memory, and imagination which all situated within the theme of environmental cleanliness. Both experts also provided feedback on the interpretation rubric used to analyze rating scores, which was later finalized through an inter-rater validation process involving consensus discussions on sample data to ensure scoring consistency and reliability (Germeroth et al., 2019).

Table 1. Instrument Blueprint for Cognitive Development Assessment on the Theme of Environmental Cleanliness

No	Cognitive Domain	Indicator	Observable Behavior (Skill Item)
1	Symbolic Thinking	Recognizing items that pollute the environment	The child can identify objects that make the environment dirty using pictures
		Understanding simple cause-effect relationships in environmental cleanliness	The child can arrange picture sequences that illustrate cause-effect events related to cleanliness
2	Memory	Understanding the function of cleaning tools	The child can name common cleaning tools in their environment
3	Language Use	Understanding simple cause-effect relationships in environmental cleanliness	The child can explain the causes of environmental pollution
4	Imagination	Understanding the function of cleaning tools	The child can demonstrate how to use cleaning tools properly
		Understanding simple cause-effect relationships in environmental cleanliness	The child can suggest preventive actions to keep the environment clean

After the instrument was finalized and validated, the research received ethical clearance from the Research and Community Engagement Board (LPPM) at the university. Research permissions were also obtained from participating early childhood institutions and informed consent was secured from the children's parents. Data collection took place over a period of two weeks across three preschools in Medan, Indonesia. Seven children aged six years participated in the study, three boys and four girls, selected through purposive sampling to ensure variation in gender and school background. During the sessions, the researcher used a combination of handwritten field notes, handheld audio recordings, and video documentation

to capture children's responses, expressions, and behavior in rich detail from multiple angles. This multimodal recording strategy was aimed at supporting post-session data review and enhancing accuracy in interpreting subtle cues (Migiro S & Magangi B, 2011).

The quantitative data derived from the rating scale were analyzed descriptively using mean scores to identify general trends and domain-specific strengths or gaps. Each child's scores were interpreted using the pre-established rubric, allowing researchers to categorize cognitive development levels across the four domains. These interpretations served as the basis for constructing individualized cognitive profiles and identifying patterns across participants. By combining qualitative interpretation with descriptive quantification, this method ensured a balanced and nuanced understanding of how cognitive development manifests in relation to a theme that is ecologically meaningful to children's everyday lives.

Table 2. Interpretation Rubric for Cognitive Development Scores

No	Average Score Range	Interpretation	Description
1	1,00 – 1,66	Emerging	At this level, children may start to recognize trash or cleaning tools in images, but their understanding remains fragmented and superficial. For example, they might be able to point to a piece of litter in a picture but struggle to verbally explain why it is problematic for the environment. Their symbolic thinking is emerging, they can match symbols (e.g., a broom or trash bin) with real-world objects, but without fully grasping their function. In terms of language use, their responses tend to be short, imitative, or off-topic. Memory is still developing, often seen when children forget names of tools or confuse their uses. Their imaginative thinking is limited; they may not yet be able to visualize what might happen if trash is left unattended. These children benefit greatly from guided discussions, storytelling, and hands-on activities that reinforce cause-effect relationships and environmental values.
2	1,67 – 2,33	Developing	At this level, children show an emerging grasp of concepts related to environmental cleanliness. They are generally able to name various cleaning tools (e.g., broom, duster, dustpan), and can often provide simple explanations about what happens when trash is not disposed of properly. Their symbolic thinking allows them to match tools to their functions or identify clean vs. dirty areas in pictures. In terms of memory, they can recall familiar objects or actions, but sometimes confuse terminology or mix up functions (e.g., using a mop for dry leaves). Their language use is developing, they can explain why trash is bad or say things like *"because the earth will be sad"*, but their reasoning

			tends to be repetitive or lacks detailed elaboration. When it comes to imagination, some children can simulate actions (e.g., how to sweep), but struggle to project consequences (e.g., what happens after several days of littering). This level reflects typical pre-operational cognition where logic is emerging, but egocentric and magical thinking may still be present. Instructional support like guided conversations, role-playing, and reflective questioning can help deepen understanding.
3	2,34 – 3,00	Established	Children at this level demonstrate a clear, coherent, and consistent understanding of environmental cleanliness. Their symbolic thinking is well-developed, they can accurately interpret visual representations (e.g., distinguishing clean vs. polluted environments in images) and make connections to real-life contexts. In terms of memory, they readily recall object names and functions (e.g., knowing that a broom is for sweeping dry leaves and a mop is for wet spills) without prompting. Their language use is also strong: they can verbally explain why throwing trash in the river causes flooding, or say things like *"If we don't clean it, germs can make us sick."* This shows an ability to express cause-effect reasoning using appropriate vocabulary. In the imagination domain, they can simulate cleaning actions during play or even suggest new solutions for keeping the environment clean (e.g., *"We can put a trash bin near the garden so people won't litter."*). Children at this level are not only cognitively aware, but also show early signs of environmental responsibility, making them ready for more complex, reflective learning experiences such as group discussions, collaborative cleaning projects, or simple science-based explorations.

3. RESULTS AND DISCUSSION

The results of this study are presented and discussed in an integrated manner, combining descriptive findings with theoretical interpretations drawn from Piaget's theory of cognitive development. The analysis focuses on how six-year-old children demonstrate cognitive skills related to environmental cleanliness across four key domains including symbolic thinking, memory, language use, and imagination. The findings are structured thematically to align with the study's research questions, first by outlining the general patterns observed in the children's cognitive profiles, then by examining each domain in detail, and finally by identifying areas of strength and domains requiring further support. Through this structure, the discussion aims to

provide both an empirical overview and developmental insights relevant to early childhood education.

3.1. Children's Cognitive Development on Environmental Cleanliness: What Do the Profiles Show?

Understanding children's cognitive profiles on environmental cleanliness provides insight into how six-year-olds make sense of concrete yet socially meaningful concepts. Using a domain-specific assessment grounded in Piagetian theory, this study evaluated children's cognitive development across 13 skill items representing four domains: symbolic thinking, memory, language use, and imagination. Each skill item was contextualized within everyday cleanliness situations, such as identifying dirty objects, recalling tool functions, or explaining cause-effect relationships in environmental settings. The children's responses were scored using a 3-point scale (1) for Emerging, (2) for Developing, and (3) for Established. Final profiles were derived by averaging item scores per child and categorizing their developmental level.
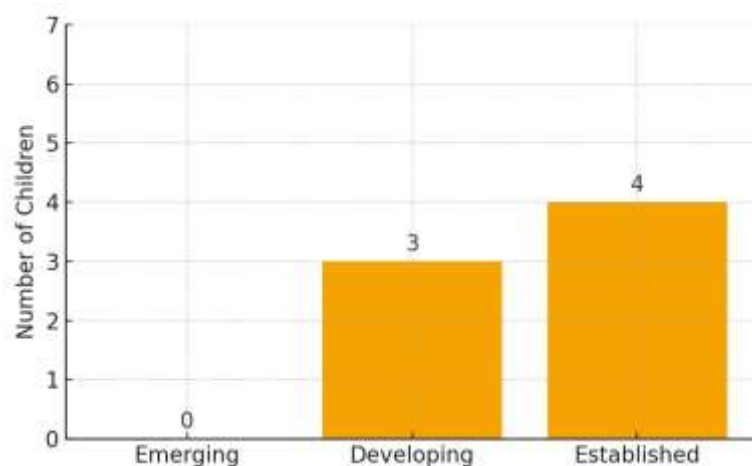

Figure 1. Children's Cognitive Domain Profile

As shown in Figure 1, none of the seven participants fell into the Emerging category, indicating that all children demonstrated at least some foundational understanding of cleanliness-related concepts. A total of three children (42.86%) were classified as Developing, meaning their cognitive abilities were progressing in line with age-related expectations. The remaining four children (57.14%) were categorized as having Established profiles, suggesting that their cognitive skills in this domain were well developed and consistently demonstrated across tasks. These results reveal two important insights. First, the absence of any participants in the Emerging category suggests that by the age of six, most children have already developed a baseline level of cognitive engagement with cleanliness-related concepts. This could reflect the influence of routine exposure to cleanliness practices in daily life, both at home and in early childhood settings. Second, while the majority of children were categorized as Established, the presence of nearly half in the Developing category highlights natural variability in development and points to specific areas, such as imagination or symbolic generalization that may require further pedagogical attention. These findings align with Jean Piaget's theory of cognitive development, which places six-year-old children within the preoperational stage. At this stage, children are expected to demonstrate emerging but not fully mature cognitive functions such as symbolic representation, memory retrieval, and simple cause-effect reasoning. The fact that most children in this study achieved at least a Developing profile confirms that their cognitive

growth is progressing within expected developmental norms. However, the gap between Developing and Established profiles also reflects Piaget's notion of uneven cognitive progression within the same stage where certain abilities, such as memory or language use, may outpace others like abstract reasoning or imaginative projection. Prior research supports these observations. For instance, Cottini et al. (2021), Gerosa et al. (2021), and Scalise & Ramani (2021) emphasized that cognitive skills like memory and symbolic understanding strengthen significantly through experiential learning, especially when embedded in meaningful contexts. Similarly, Francis & Gibson (2023), Nguyen (2021), and Russ (2021) found that pretend play and thematic storytelling improve both symbolic thinking and language use. However, imagination while naturally emerging at this stage often requires explicit scaffolding through adult interaction and creative play structures. The findings of this study echo this pattern, showing stronger development in memory and language, with symbolic and imaginative domains lagging slightly behind. Therefore, this overview of children's cognitive profiles offers a snapshot of how six-year-olds comprehend and internalize the concept of environmental cleanliness. The distribution reflects both developmental strengths and areas needing further support, thereby justifying a domain-specific analysis in the following section.

3.2. Tracing Development Across Domains: Symbolic Thinking, Memory, Language Use, and Imagination

Building on the literature that calls for more contextualized and meaningful assessments of early cognition (Aksoy Assist, 2019; Engler & Alfonso, 2020; Mahyuddin et al., 2024), this section presents domain-specific analyses to explore how children understand cleanliness through symbolic, linguistic, and imaginative modes of thinking.

While the overall cognitive profiles of the children revealed a positive trend, a more nuanced picture emerges when the data are disaggregated by cognitive domain. The assessment instrument was structured to evaluate four specific domains including symbolic thinking, memory, language use, and imagination. Each domain was assessed using 3–4 skill items situated in the context of environmental cleanliness, and the average scores were computed to understand developmental trends. Table 3 presents the average scores across the four domains.

Table 3. Average Scores Across Four Domains of Preoperational Development

No	Cognitive Domain	Average Score
1	Symbolic Thinking	2.29
2	Memory	2.50
3	Language Use	2.38
4	Imagination	2.29

The table illustrates two key findings. First, children showed the highest average performance in the domain of memory (2.50), followed by language use (2.38), both of which fall within the Established category. This suggests that children were able to recall relevant experiences and describe cleanliness-related concepts with relative fluency. For example, several children were able to describe past actions like sweeping or cleaning their classroom, and accurately name tools such as a broom, dustpan, or mop. These findings support previous studies (Akhavan Tafti et al., 2023; Cottini et al., 2021) indicating that memory and expressive language in preschoolers are often strengthened through repeated exposure to everyday routines, especially those that are meaningful and contextually embedded. Second, both symbolic thinking and imagination received average scores of 2.29, placing them in the

Developing category just below the threshold for Established. This suggests that while children demonstrate an emerging capacity in these areas, they may still require scaffolding to deepen their conceptual understanding and creative engagement. For instance, although most children could point to dirty objects in a picture or describe a clean environment, fewer were able to explain symbolic relationships, for example understanding that trash symbolizes environmental damage or construct hypothetical consequences of unclean behaviour beyond literal statements such as *there will be flies*. These limitations align with Piaget's characterization of preoperational thought as intuitive and tied to concrete experiences, with symbolic abstraction and imaginative projection still in the process of maturing. Furthermore, the slight lag in imagination is not unexpected. As noted by Francis & Gibson (2023) and Nguyen (2021), imaginative reasoning in early childhood often requires structured opportunities, such as pretend play, storytelling, and guided discussion. In this study, while children engaged well with real images and verbal prompts, their ability to extend ideas into imagined futures or symbolic narratives remained limited suggesting a need for more explicit stimulation in this domain. Taken together, these domain-level findings emphasize that even within an overall positive developmental profile, children's cognitive growth is multifaceted and uneven across domains. While memory and language appear to be more solidified by age six, symbolic abstraction and imaginative reasoning are still consolidating and may benefit from targeted educational strategies. The following section will further explore what these domain differences imply for early childhood practice and curriculum design.

3.3. Domains That Flourish and Those That Need Support: Where Should We Focus?

The comparison of average cognitive scores across domains reveals important developmental contrasts that warrant deeper reflection. While all children in this study demonstrated at least a foundational level of cognitive engagement with the theme of environmental cleanliness, their performance across different cognitive domains was uneven. Specifically, the domains of memory and language use showed relatively higher average scores both falling within the *Established* range, while symbolic thinking and imagination remained in the *Developing* category. This divergence offers critical insight into how children's cognitive development is shaped not only by age and stage but also by the types of experiences and cognitive demands embedded in their daily environments. These contrasts suggest that some cognitive domains are more naturally supported in early childhood routines. Memory and language use are constantly activated through conversation, storytelling, instructions, and repeated activities, many of which are embedded within the familiar context of cleanliness at home and school. In contrast, symbolic thinking and imagination require a qualitatively different kind of engagement, such as one that invites children to go beyond the concrete, to re-represent objects, and to envision alternative realities or hypothetical outcomes. These abilities, while emerging in the preoperational stage, often need to be intentionally nurtured through guided role-play, symbolic modelling, or *open-ended what if questions* that stimulate abstract and flexible thinking. The absence of any children in the *Emerging* category is an encouraging sign that all participants had achieved a basic cognitive understanding of environmental cleanliness. However, the presence of a split between *Developing* and *Established* profiles indicates differentiated levels of readiness, particularly in how children transfer and expand their knowledge. This raises important pedagogical questions. For instance, *are current learning environments offering enough opportunities for symbolic and*

imaginative engagement? Are classroom activities too focused on factual recall and descriptive labelling, without extending into abstraction and reasoning?

From a theoretical perspective, these findings affirm Piaget's notion that cognitive development in the preoperational stage is uneven, and that progression within this stage varies by domain and stimulus. While memory and linguistic structures may mature earlier due to their reliance on repetition and exposure, symbolic function and imaginative thought evolve more slowly and require structured intervention. As Scalise & Ramani (2021) argue, symbolic and imaginative competencies are not automatic by-products of maturation, they are cultivated through play, narrative, and dialogic interaction (Eriksson, 2024). In practical terms, early childhood educators can take these insights as a call to balance instruction across domains. Activities that involve memory recall and naming tools are clearly effective, but they should be complemented by learning experiences that invite symbolic substitutions, speculative storytelling, or dramatized cleaning scenarios. Such approaches not only help elevate the weaker domains but also create a more holistic cognitive environment where diverse types of thinking are activated (Nawaz et al., 2024; Nobre et al., 2023; Salahodjaev, 2018).

In summary, this study reveals that while some cognitive domains flourish naturally through children's daily experiences, others remain underdeveloped without intentional support. Recognizing these patterns can inform more balanced curriculum planning and encourage educators to move beyond content delivery, toward rich, multi-dimensional cognitive engagement tailored to each domain's developmental needs. This study extends previous findings on cognitive development in early childhood by applying them within a socially relevant and ecologically valid theme, such as environmental cleanliness (Collado & Evans, 2023; Kavaz et al., 2021; Rothstein et al., 2021). Unlike earlier research that assessed children's environmental knowledge as static outcomes (Collado & Evans, 2023; Evans, 2006),this study explores the underlying cognitive mechanisms that shape how children think, remember, and reason about cleanliness in their everyday world.

4. CONCLUSION

This study demonstrated that six-year-old children exhibit diverse levels of cognitive development when engaging with the theme of environmental cleanliness. Most participants displayed an overall cognitive profile at the established level, with particular strength in memory and language use. Children effectively recalled environmental tools and routines and could verbally describe their functions, reflecting their capacity to process and articulate familiar environmental experiences. However, the domains of symbolic thinking and imagination were relatively less developed. Several children struggled to interpret symbolic images or anticipate the future impact of unhygienic behaviour highlighting the need for more intentional support in fostering abstract and imaginative reasoning. These findings offer both theoretical and practical implications. Theoretically, the study extends Piagetian developmental constructs into an authentic, socially relevant theme environmental cleanliness bridging a gap in the literature where real-world cognitive applications remain underexplored. Practically, the study provides educators and curriculum developers with a developmentally grounded assessment model to gauge children's thinking beyond academic domains. By using a thematic lens grounded in everyday routines, teachers can tailor learning experiences that promote environmental awareness through storytelling, guided reflection, and symbolic play. Moreover,

the use of assessment-as-learning strategies reinforces children's agency by positioning them as meaning-makers rather than passive respondents.

One limitation of this study lies in its small sample size and limited demographic diversity, which constrains the generalizability of findings. The observational scoring process, despite being inter-rater validated, also carries inherent subjectivity. Additionally, this study did not measure children's prior exposure to environmental content, which may have influenced their responses. Therefore, Future research should involve a larger and more diverse participant pool, allowing for comparison across different school contexts, cultural backgrounds, or levels of environmental education exposure. Mixed-method designs incorporating children's drawings, dramatizations, or parent-teacher interviews may enrich the interpretive depth of cognitive responses. Future studies could also evaluate longitudinal effects of thematic environmental interventions on cognitive growth and behavioural outcomes. Overall, this study contributes a novel framework for assessing preschoolers' cognition within ecologically valid themes and offers actionable insights for fostering early environmental responsibility through developmentally appropriate, cognition-sensitive approaches.

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