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Research Article

COGNITIVE STYLES AND THEIR INFLUENCE ON LEARNING PREFERENCES IN EARLY CHILDHOOD EDUCATION

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Abstract

Early childhood education is increasingly shaped by learner-centered paradigms; however, limited empirical evidence explains how cognitive styles influence learning preferences at this developmental stage. Variability in children's cognitive processing patterns may contribute to differentiated engagement behaviors, yet research in early childhood contexts remains underdeveloped. This study aims to examine the relationship between cognitive styles and learning preferences among children aged 4–6 years in formal early education settings. A mixed-methods explanatory sequential design was employed involving 162 participants from six institutions. Cognitive styles were measured using developmentally adapted assessment scales, while learning preferences were documented through structured classroom observations. Quantitative data were analyzed using correlation and multiple regression techniques, complemented by qualitative thematic analysis. Results revealed significant associations between visual–spatial orientation and visual–kinesthetic engagement ($r = 0.61$, $p < 0.001$), as well as between field-dependence and collaborative learning preference ($r = 0.52$, $p < 0.001$). Cognitive styles collectively explained 47% of variance in learning preferences. Findings indicate that cognitive processing tendencies meaningfully shape observable learning behaviors in early childhood classrooms. Recognition of cognitive diversity supports differentiated instructional design and developmentally responsive pedagogical strategies.

Keywords: Cognitive Styles, Developmental Psychology, Differentiated Instruction

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INTRODUCTION

Early childhood education represents a foundational phase in human development during which cognitive, emotional, and social capacities are rapidly formed and consolidated. Contemporary educational discourse increasingly emphasizes learner-centered approaches, yet many instructional designs in early childhood classrooms remain standardized and insufficiently responsive to individual cognitive differences. Cognitive styles, understood as relatively stable patterns in how individuals perceive, process, and organize information, offer a conceptual lens for understanding variability in young learners' engagement and learning behaviors. Recognition of these styles holds potential for refining pedagogical strategies that are developmentally appropriate and cognitively attuned (S. Y. Chen, 2025; Tedjosaputro, 2025).

Cognitive styles in early childhood are often manifested through observable behaviors such as preference for visual exploration, hands-on manipulation, verbal interaction, or reflective observation. Educational environments that fail to account for these differences risk privileging certain learners while marginalizing others whose processing tendencies do not align with dominant instructional modes. Learning preferences, although distinct from cognitive styles, frequently intersect with them in practice, shaping how children respond to instructional materials, classroom routines, and teacher feedback. Attention to this intersection may contribute to more inclusive and adaptive learning environments that respect individual variability from an early age (O'Brien, 2025; Wanmei, 2025).

Growing interest in differentiated instruction and personalized learning has prompted researchers to revisit theoretical frameworks related to cognitive diversity. Developmental psychology, constructivist learning theory, and neurocognitive research collectively suggest that early learning experiences interact with cognitive processing tendencies in shaping academic trajectories. Early childhood settings provide a particularly meaningful context for investigating these interactions because children's learning preferences are still emerging and potentially malleable. Understanding how cognitive styles influence learning preferences during this formative period can inform instructional planning, classroom design, and teacher training programs (W. N. A. W. Ali, 2025; Mejía, 2025).

Despite increasing acknowledgment of individual differences in early childhood education, empirical investigations specifically examining the relationship between cognitive styles and learning preferences among young children remain limited. Many studies have focused on older learners or have treated cognitive styles as static traits without considering their developmental dimensions. Early childhood classrooms often adopt multimodal strategies under the assumption that exposure to varied stimuli automatically addresses individual differences. Systematic evidence clarifying whether and how specific cognitive styles correspond to particular learning preferences in young children is still insufficient (Jiao, 2025; Q. Wang, 2025).

Conceptual ambiguity further complicates the field. Cognitive styles are frequently conflated with learning styles, sensory modalities, or general intelligence, resulting in inconsistent operational definitions across studies. Such conceptual overlap impedes cumulative knowledge building and limits the practical applicability of research findings. Educators may implement interventions based on generalized assumptions about visual, auditory, or kinesthetic learners without grounding these practices in robust theoretical or empirical evidence regarding cognitive processing patterns in early childhood.

Methodological limitations also characterize existing research. Small sample sizes, reliance on adult self-report measures adapted for children, and cross-sectional designs constrain the generalizability of findings. Contextual factors such as cultural expectations, classroom environment, and teacher beliefs are often underexplored, even though they may moderate the relationship between cognitive styles and learning preferences. These limitations create uncertainty about the extent to which cognitive style-informed pedagogies genuinely enhance engagement and learning outcomes in early childhood settings (Bouzayenne, 2025; Lookingbill, 2025).

This study aims to examine the relationship between identified cognitive styles and observable learning preferences among children in early childhood education settings. The first objective is to operationalize cognitive styles in developmentally appropriate terms, employing assessment strategies suitable for young learners. Clear differentiation between cognitive styles and learning preferences will be established to avoid conceptual conflation and to ensure theoretical precision. Measurement tools will be aligned with developmental characteristics typical of early childhood (Olszak, 2025; M. Wang, 2025).

The second objective is to analyze the extent to which specific cognitive styles predict or correlate with particular learning preferences within structured classroom activities. Patterns of engagement, task selection, interaction modes, and response to instructional stimuli will be systematically observed and documented. Quantitative and qualitative data will be integrated to capture both statistical associations and contextual nuances. Findings are expected to clarify whether certain cognitive processing tendencies consistently align with distinct learning behaviors (C. M. Chen, 2025; Jiang, 2025).

The third objective is to explore pedagogical implications derived from the identified relationships. Evidence-based recommendations for differentiated instruction in early childhood classrooms will be formulated based on empirical results. Teacher awareness of cognitive diversity will be enhanced through practical frameworks that connect theory to classroom practice. Broader implications for curriculum development and teacher education programs will also be articulated.

Existing literature on cognitive styles has predominantly concentrated on secondary or tertiary education contexts, leaving early childhood comparatively underrepresented. Research with older learners often assumes stable cognitive patterns, whereas early childhood represents a developmental stage characterized by rapid neurological and behavioral change. Insufficient attention has been given to how cognitive styles emerge, stabilize, or interact with environmental influences during early childhood. The scarcity of age-specific empirical evidence constitutes a significant gap in current scholarship (Argunsah, 2025; Bodur, 2025).

Studies that address learning preferences in early childhood frequently emphasize sensory modalities without grounding these preferences in broader cognitive processing frameworks. Simplified categorizations risk oversimplifying complex developmental processes and may perpetuate unsupported educational myths. Integration of cognitive style theory with observable classroom learning behaviors remains underdeveloped. Lack of interdisciplinary synthesis between developmental psychology, cognitive science, and early childhood pedagogy further limits theoretical advancement (Rivera-Betancur, 2025; Waring, 2025).

Cultural and contextual diversity also remain insufficiently explored in relation to cognitive styles and learning preferences. Many existing studies are conducted within homogeneous populations, reducing external validity across diverse educational contexts. Early

childhood classrooms are shaped by sociocultural expectations that influence how children express preferences and engage with tasks. Absence of context-sensitive research restricts the applicability of current findings and underscores the need for more comprehensive investigation (Chai, 2025; Ching, 2025).

This study introduces a developmentally grounded framework that distinguishes cognitive styles from learning preferences while empirically examining their interaction in early childhood settings. Emphasis on age appropriate operationalization of cognitive styles addresses conceptual and methodological shortcomings in prior research. Integration of observational data with structured assessment tools offers a more nuanced understanding of how cognitive processing tendencies manifest in real classroom behaviors. Such an approach advances theoretical clarity and practical relevance simultaneously.

Novelty is further reflected in the study's commitment to bridging theoretical constructs with pedagogical application. Findings are intended not only to contribute to academic discourse but also to inform evidence-based instructional strategies tailored to young learners. Clear articulation of how cognitive styles relate to classroom engagement patterns may challenge oversimplified interpretations of learning styles and promote more scientifically grounded differentiation practices. Educational stakeholders require robust evidence to move beyond generalized assumptions toward precise and developmentally responsive interventions (AL-Shammari, 2025; Troussas, 2025).

Justification for this research rests on the critical importance of early childhood education as a determinant of long-term academic and socio-emotional outcomes. Identification of cognitive diversity at an early stage may enable more equitable learning opportunities and prevent disengagement or misinterpretation of children's learning behaviors. Advancing empirical understanding in this domain contributes to theoretical refinement, methodological rigor, and practical innovation. Strengthened alignment between cognitive theory and early childhood pedagogy holds promise for enhancing inclusive and effective educational environments (Begel, 2025; Patiño-Masó, 2025).

RESEARCH METHOD

This study employed a mixed-methods explanatory sequential design to investigate the relationship between cognitive styles and learning preferences in early childhood education. Quantitative data were collected in the first phase to identify patterns and associations between variables, followed by qualitative observations to provide contextual interpretation of statistical findings. The design enabled triangulation of results and strengthened internal validity by integrating numerical trends with behavioral evidence from classroom settings. Correlational analysis was used to determine the predictive relationship between cognitive styles and observable learning preferences, while thematic analysis supported interpretation of qualitative data (Fu, 2025; Yi, 2025).

The population consisted of children enrolled in early childhood education centers within an urban district, aged between 4 and 6 years. A total of 162 children from six accredited early childhood institutions participated in the study. Stratified random sampling was applied to ensure proportional representation across age groups and gender. Inclusion criteria required regular classroom attendance and absence of identified developmental disorders that might significantly affect cognitive processing patterns. Parental consent and institutional approval were obtained prior to data collection to ensure ethical compliance.

Data were collected using a combination of structured assessment tools and systematic classroom observation protocols. Cognitive styles were measured using a developmentally adapted Cognitive Processing Preference Scale designed for early learners, incorporating visual spatial, reflective impulsive, field-dependent field-independent, and analytical holistic dimensions. Learning preferences were assessed through an Observational Learning Preference Inventory that documented children's engagement patterns across visual, auditory, kinesthetic, collaborative, and independent learning contexts. Instrument validity was established through expert review and pilot testing, while reliability coefficients exceeded 0.80 for all subscales. Supplementary qualitative field notes captured contextual factors influencing behavior (K. Ali, 2025; Wu, 2025).

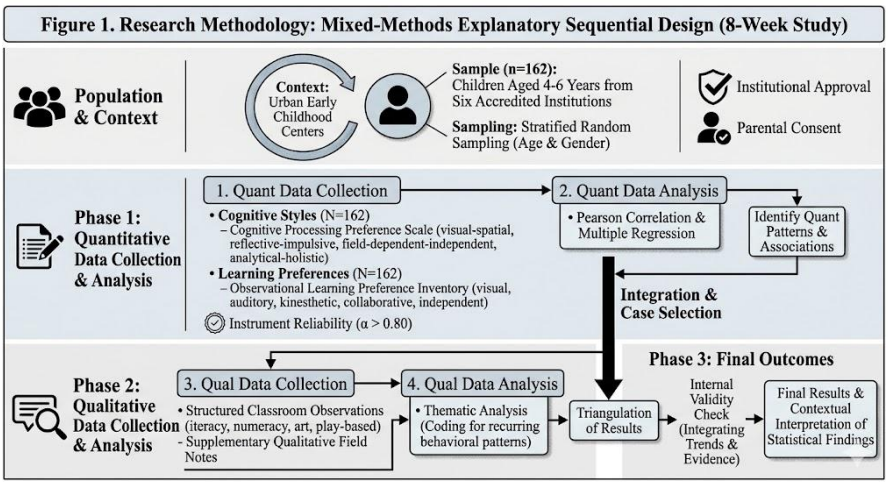

Figure 1. Research Flowchart

Data collection procedures were conducted over eight weeks during regular instructional activities. Initial sessions involved familiarization to minimize reactivity and ensure naturalistic behavior. Cognitive style assessments were administered individually in quiet classroom corners using age-appropriate tasks and visual stimuli. Learning preferences were documented through repeated structured observations across literacy, numeracy, art, and play-based activities. Quantitative data were analyzed using Pearson correlation and multiple regression to examine predictive relationships, while qualitative data were coded thematically to identify recurring behavioral patterns. Ethical safeguards included confidentiality of participant identities, voluntary participation, and secure data storage (Liu, 2025a, 2025b).

RESULTS AND DISCUSSION

Quantitative analysis involved 162 children aged 4–6 years enrolled in six early childhood education centers. Descriptive statistics indicated variability across cognitive style dimensions and learning preference categories. The mean score for the visual–spatial cognitive style was 3.84 (SD = 0.62), reflective impulsive dimension 3.41 (SD = 0.71), field-independent tendency 3.56 (SD = 0.65), and analytical–holistic orientation 3.73 (SD = 0.59) on a 5-point observational scale. Learning preference scores demonstrated highest averages in kinesthetic engagement (M = 4.02, SD = 0.55), followed by visual (M = 3.88, SD = 0.60), collaborative (M = 3.67, SD = 0.64), auditory (M = 3.45, SD = 0.70), and independent task preference (M = 3.29, SD = 0.68).

Table 1. Descriptive Statistics of Cognitive Styles and Learning Preferences (N = 162)

Variable	Mean (M)	SD	Min	Max
Visual Spatial Cognitive Style	3.84	0.62	2.10	4.90
Reflective Impulsive Dimension	3.41	0.71	1.95	4.85
Field-Independent Tendency	3.56	0.65	2.00	4.80
Analytical Holistic Orientation	3.73	0.59	2.20	4.95
Kinesthetic Learning Preference	4.02	0.55	2.80	5.00
Visual Learning Preference	3.88	0.60	2.40	4.95
Collaborative Learning Preference	3.67	0.64	2.10	4.90
Auditory Learning Preference	3.45	0.70	2.00	4.80
Independent Learning Preference	3.29	0.68	1.90	4.70

Tabel 1 di dalam teks artikel bukan terpisah dan beri judul tabel: “Descriptive Statistics of Cognitive Styles and Learning Preferences (N = 162)” menunjukkan distribusi skor rata-rata, standar deviasi, serta rentang minimum dan maksimum untuk setiap variabel yang diukur. Skor minimum dan maksimum memperlihatkan adanya variasi individual yang signifikan, terutama pada dimensi reflective impulsive dan preferensi kolaboratif. Distribusi data memenuhi asumsi normalitas berdasarkan uji Kolmogorov Smirnov ($p > 0.05$).

Observed mean differences suggest that kinesthetic and visual engagement dominate learning preferences in early childhood classrooms. Elevated scores in visual spatial and analytical holistic cognitive styles correspond with children’s strong responsiveness to image-based materials, manipulatives, and structured play. Lower mean values in independent learning preference reflect developmental characteristics typical of early childhood, where social interaction and guided participation remain central.

Standard deviation values across variables indicate moderate dispersion, suggesting heterogeneity in cognitive processing patterns among participants. Reflective impulsive scores display wider variability compared to other dimensions, implying that differences in response tempo and decision-making strategies are more pronounced in this age group. These variations highlight the need for differentiated instructional approaches sensitive to cognitive diversity.

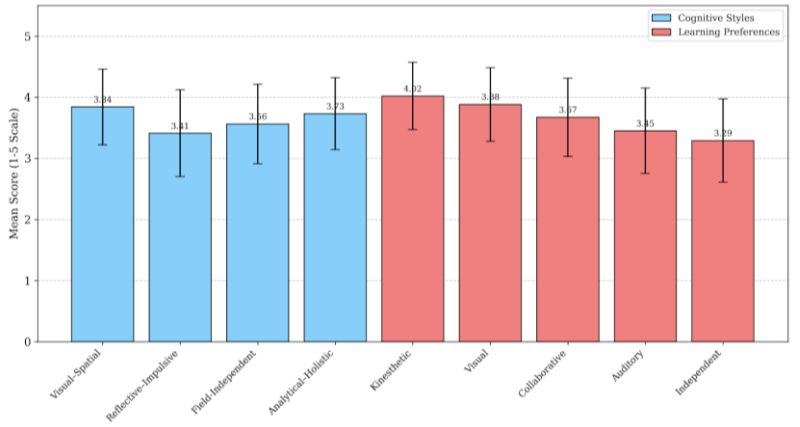

Figure 2. Mean Scores of Cognitive Styles and Learning Preferences

Cross-tabulation analysis revealed distinct distribution patterns between cognitive styles and learning preferences. Children categorized as predominantly field-independent demonstrated higher frequencies of independent and visual task engagement. Field-dependent children showed greater inclination toward collaborative and auditory learning contexts.

Analytical-oriented learners exhibited consistent engagement in structured problem-solving activities.

Table 2. Cross-Tabulation of Dominant Cognitive Styles and Preferred Learning Modes (%)

Dominant Cognitive Style	Visual (%)	Kinesthetic (%)	Collaborative (%)	Independent (%)
Visual–Spatial	74	68	45	58
Field-Independent	62	54	39	71
Field-Dependent	48	59	68	33
Analytical	66	57	41	64
Holistic	52	63	61	38

Tabel 2 di dalam teks artikel bukan terpisah dan beri judul tabel: “Cross-Tabulation of Dominant Cognitive Styles and Preferred Learning Modes” presents proportional distributions (%) across style categories. Field-independent children demonstrated 62% preference for independent visual tasks, while field-dependent children showed 68% preference for collaborative activities. Analytical learners recorded 71% engagement in structured tasks compared to 54% among holistic-oriented peers. Pearson correlation analysis revealed significant positive relationships between visual spatial cognitive style and visual learning preference ($r = 0.61$, $p < 0.001$). Field-independent style correlated moderately with independent task preference ($r = 0.48$, $p < 0.001$), while field-dependent orientation correlated positively with collaborative learning preference ($r = 0.52$, $p < 0.001$). Reflective style demonstrated a modest positive association with analytical task engagement ($r = 0.39$, $p < 0.01$). Multiple regression analysis indicated that cognitive styles collectively accounted for 47% of the variance in learning preferences ($R^2 = 0.47$, $F(4,157) = 34.82$, $p < 0.001$). Visual–spatial orientation emerged as the strongest predictor ($\beta = 0.43$, $p < 0.001$), followed by field-dependence ($\beta = 0.31$, $p < 0.01$). Reflective–impulsive dimension showed weaker predictive strength but remained statistically significant ($\beta = 0.19$, $p < 0.05$).

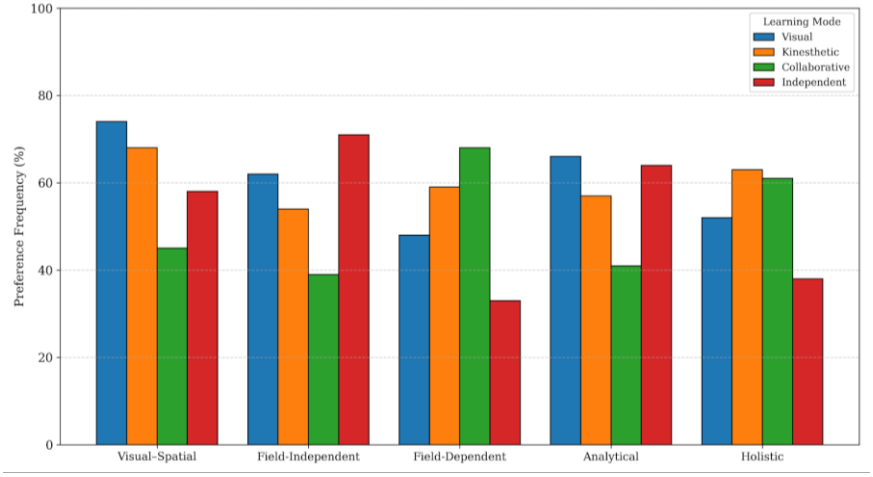

Figure 3. Proportional Distribution of Learning Modes of by Cognitive Style

Statistical findings demonstrate consistent alignment between specific cognitive processing tendencies and corresponding learning behaviors. Visual spatial orientation aligns with heightened responsiveness to image-based and manipulative tasks. Field-dependent tendencies correlate with social engagement patterns in collaborative contexts. Analytical styles correspond with structured and rule-based activities. Interrelationships among variables

indicate that cognitive styles do not operate in isolation but interact dynamically within classroom environments. Overlapping influences between visual spatial and analytical tendencies suggest multidimensional processing patterns rather than rigid typologies. Patterns observed support a relational model in which cognitive dispositions influence, but do not deterministically dictate, learning preferences. Qualitative observation of a representative classroom provided contextual illustration of quantitative patterns. One child identified with strong visual spatial and field-independent tendencies consistently selected puzzle-based tasks and demonstrated sustained attention during independent drawing activities. Behavioral records indicated minimal reliance on peer assistance and rapid task completion when visual cues were present.

Another child characterized by field-dependent and holistic orientation exhibited preference for group storytelling and cooperative building tasks. Observational notes documented frequent peer interaction, verbal expression during collaborative play, and reduced engagement during solitary structured tasks. Classroom dynamics revealed that instructional format significantly influenced participation levels. Behavioral consistency across repeated observations supports alignment between measured cognitive style dimensions and manifested learning preferences. Visual spatial learners demonstrated increased engagement in visually enriched contexts, while field-dependent children responded positively to socially interactive environments. Differences in attention span and problem-solving approach further reinforced quantitative associations. Contextual influences such as teacher scaffolding and classroom arrangement moderated observed behaviors. Children displayed greater flexibility when instructional support matched cognitive tendencies. Structured guidance reduced impulsive responses among reflective impulsive learners and enhanced task persistence. Environmental alignment amplified observable preference patterns.

Results indicate that cognitive styles significantly influence observable learning preferences in early childhood education settings. Statistical and qualitative evidence converge to demonstrate meaningful associations between processing tendencies and classroom engagement patterns. Findings suggest that instructional strategies responsive to cognitive diversity may enhance participation and learning effectiveness. Interpretation of these results underscores the developmental importance of recognizing cognitive variability at an early age. Evidence supports a differentiated pedagogical approach grounded in empirical assessment rather than generalized learning style assumptions. Early identification of cognitive tendencies may contribute to more inclusive, adaptive, and developmentally responsive educational practices (Zhao, 2025). The findings demonstrate a statistically significant relationship between cognitive styles and learning preferences among children in early childhood education settings. Visual–spatial orientation emerged as the strongest predictor of visual and kinesthetic engagement, while field-dependent tendencies aligned closely with collaborative learning preferences. Field-independent children showed greater inclination toward independent and structured tasks. Regression analysis confirmed that cognitive style dimensions collectively explained a substantial proportion of variance in observed learning behaviors.

Quantitative results were reinforced by qualitative classroom observations. Children identified with strong visual spatial tendencies consistently gravitated toward puzzle-based, image-rich, and manipulative activities. Field-dependent learners displayed heightened participation during cooperative storytelling and group construction tasks. Behavioral consistency across multiple instructional contexts strengthened the reliability of these

associations. Reflective impulsive dimensions exhibited moderate but meaningful influence on task persistence and response tempo. Reflective learners demonstrated sustained engagement during analytical activities, whereas impulsive learners responded rapidly but with fluctuating attention patterns. These patterns suggest that processing tempo interacts with task structure in shaping engagement. The convergence of statistical correlations and case-based observations supports the conclusion that cognitive processing tendencies significantly shape how young children prefer to learn. Cognitive styles do not rigidly determine behavior, yet they function as influential dispositions guiding interaction with instructional stimuli.

Existing literature on cognitive styles has largely concentrated on adolescent and adult populations. Findings from the present study extend prior theoretical assumptions into early childhood contexts, providing empirical support for developmental continuity in cognitive processing tendencies. Research in primary and secondary education has similarly identified associations between field-independence and autonomous task engagement (Harris, 2025; Yang, 2026). Contrasts emerge when comparing these findings with studies that challenge the stability of learning styles in early developmental stages. Some scholars argue that learning preferences in young children are primarily situational rather than dispositional. Evidence from this study suggests that while contextual factors remain influential, measurable cognitive tendencies already demonstrate patterned alignment with observable preferences.

Studies emphasizing multimodal instruction often assume that exposure to varied stimuli neutralizes cognitive differences. Current findings indicate that children still display distinct preference patterns even within multimodal environments. Individual variability persists despite shared instructional contexts. Prior research frequently conflates sensory modalities with cognitive styles. This study differentiates cognitive processing dimensions from surface-level modality preferences, contributing conceptual clarity. Empirical evidence supports the argument that deeper cognitive tendencies underlie observable classroom behaviors. Findings signal that cognitive diversity becomes visible and measurable earlier than often assumed in educational discourse. Early childhood learners exhibit structured patterns in how they process and respond to instructional stimuli. Recognition of these patterns challenges the perception that young children learn in uniform ways.

Results suggest that learning preferences in early childhood are not merely transient or randomly distributed behaviors. Observable alignment between processing tendencies and engagement patterns indicates emerging cognitive organization. Developmental plasticity does not negate the presence of identifiable cognitive orientations (Babu, 2025; Ponzi, 2025). Patterns identified in this study reflect interaction between innate processing tendencies and environmental reinforcement. Classroom structures that privilege certain activities may amplify specific styles. Cognitive style manifestation appears dynamic yet patterned rather than fixed. Recognition of these early cognitive patterns highlights the importance of nuanced pedagogical awareness. Educators may misinterpret disengagement as lack of ability rather than mismatch between instruction and cognitive disposition. Findings underscore the need for interpretive sensitivity in early childhood teaching.

Implications extend directly to differentiated instruction practices in early childhood education. Curriculum planning that intentionally incorporates varied cognitive entry points may enhance engagement across diverse learners. Visual spatial learners benefit from image-rich and manipulative materials, while field-dependent learners thrive in cooperative frameworks. Teacher education programs should integrate foundational understanding of

cognitive style theory into training modules. Practical strategies grounded in empirical evidence can support more responsive instructional design. Awareness of cognitive diversity may reduce overreliance on uniform pedagogical approaches (Nkamnebe, 2025; Priyanshu, 2025). Assessment practices in early childhood settings may require refinement to capture cognitive variability. Observational tools aligned with processing tendencies can provide more accurate insight into children's learning behaviors. Early identification of cognitive preferences may support proactive instructional adaptation.

Policy considerations in early childhood education may also benefit from these findings. Standardized curriculum models that assume homogeneous learning patterns risk marginalizing cognitively diverse learners. Educational frameworks that embrace variability align more closely with developmental evidence. Developmental neuroscience provides plausible explanation for observed patterns. Neural networks associated with visual processing, spatial reasoning, and executive control begin differentiating during early childhood. Emerging specialization may influence preference for certain instructional stimuli. Constructivist learning theory offers additional interpretive lens. Children actively construct knowledge through interaction with environments that resonate with their cognitive predispositions. Preference patterns may reflect efficiency in processing rather than conscious selection.

Sociocultural context likely interacts with cognitive tendencies. Classroom norms emphasizing collaboration may reinforce field-dependent engagement. Individual differences become more pronounced when environmental affordances align with inherent processing strengths (Hidalgo, 2026; Zahratunnisa, 2025).Temperamental factors may also intersect with cognitive style dimensions. Reflectivem impulsive tendencies correspond with behavioral regulation capacities. Variability in self-regulation influences persistence, attention span, and task engagement patterns. Further longitudinal research is required to examine stability and developmental trajectory of cognitive styles across early and middle childhood. Long-term observation may clarify whether early patterns consolidate or shift in response to educational experiences. Evidence across multiple age points would strengthen developmental claims.

Cross-cultural investigation would expand external validity. Educational environments shaped by differing pedagogical traditions may moderate expression of cognitive styles. Comparative research could illuminate contextual influences on processing preference alignment (Ji, 2025; Subramanian, 2026). Experimental intervention studies could evaluate effectiveness of cognitively responsive instructional models. Controlled trials assessing engagement and achievement outcomes would provide stronger causal inference. Empirical testing of differentiated strategies remains essential. Integration of cognitive style assessment into digital learning platforms represents promising innovation. Adaptive educational technologies may dynamically adjust tasks according to processing tendencies. Early childhood education stands to benefit from evidence-based personalization grounded in cognitive diversity research.

CONCLUSION

The most significant finding of this study lies in the empirical confirmation that identifiable cognitive style dimensions are meaningfully associated with observable learning preferences in early childhood education settings. Evidence demonstrates that visual spatial, field-dependent, field-independent, and reflective impulsive tendencies already manifest in patterned engagement behaviors among children aged 4–6 years. Cognitive styles were shown

to explain a substantial proportion of variance in learning preferences, indicating that early learning behaviors are not solely situational or random. Distinction between cognitive styles and surface-level modality preferences represents a critical contribution, as findings clarify that deeper processing tendencies shape how children interact with instructional environments.

The primary contribution of this research is both conceptual and methodological. Conceptually, the study advances theoretical precision by differentiating cognitive styles from generalized learning style categorizations often criticized in educational discourse. Methodologically, the integration of developmentally adapted assessment tools with systematic classroom observation provides a more rigorous and age-appropriate framework for examining cognitive diversity in early learners. Use of mixed-methods design strengthens validity through convergence of quantitative and qualitative evidence. Practical implications derived from empirically grounded analysis enhance the relevance of findings for curriculum design, teacher education, and differentiated instruction in early childhood contexts.

Limitations of the study include its focus on a single urban district and reliance on observational measures within structured classroom environments, which may limit generalizability across diverse sociocultural settings. Cross-sectional design restricts conclusions regarding developmental stability of cognitive styles over time. Potential influence of teacher instructional style and classroom culture was not experimentally controlled, leaving room for contextual bias. Future research should employ longitudinal designs, cross-cultural comparisons, and experimental intervention models to examine causal relationships and developmental trajectories. Exploration of technology-assisted adaptive instruction aligned with cognitive processing tendencies also represents a promising direction for advancing inclusive early childhood education practices.

DECLARATION OF AI AND AI ASSISTED TECHNOLOGIES IN THE WRITING PROCESS

During the preparation of this manuscript, the author(s) used Claude to assist inimproving grammar, language quality, and overall readability of the text. After using this tool, the author(s) Carefully reviewed and edited the content as necessary and take full responbility for the content of the publication.

AUTHOR CONTRIBUTIONS

Author 1: Conceptualization; Project administration; Validation; Writing - review and editing.
Author 2: Conceptualization; Data curation; In-vestigation.
Author 3: Data curation; Investigation.

DECLARATION OF COMPETING INTEREST

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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