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Research Article

The Role of Play in Early Childhood Education for Developing Creative Problem-Solving Skills: A Longitudinal Study

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Abstract
Play is increasingly recognized as a crucial foundation for fostering creativity and problem-solving abilities in early childhood education. In a rapidly changing world that demands flexible thinking and innovation, understanding how different forms of play contribute to cognitive development has become a central concern for educators and researchers. This study aims to examine the longitudinal relationship between structured and unstructured play activities and the development of creative problem-solving skills among children aged 4 to 7 years. A mixed-method longitudinal design was employed over a three-year period, involving 120 children from five early childhood education centers. Quantitative data were collected through standardized creativity and problem-solving assessments, while qualitative observations and teacher interviews provided contextual insights into behavioral and cognitive changes. Results revealed that children consistently engaged in imaginative and cooperative play demonstrated significantly higher gains in fluency, flexibility, and originality in problem-solving tasks. The findings also indicate that teacher-facilitated play environments amplify these developmental effects by promoting autonomy and social interaction. The study concludes that play is not merely a recreational activity but a critical pedagogical tool that nurtures creative cognition and adaptive problem-solving in early learning contexts.

Keywords: Early Childhood, Longitudinal Study, Problem-Solving

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INTRODUCTION

Early childhood represents a critical period for cognitive, social, and emotional development, during which foundational skills such as creativity, imagination, and problem-solving begin to take shape. Play has long been regarded as a central component of early learning, serving as a natural and dynamic medium through which children explore their environment, test hypotheses, and make sense of complex concepts (Ismaniar et al., 2025; Ohnuki, 2025). Scholars such as Vygotsky and Piaget have emphasized the role of play as a bridge between concrete experience and abstract thinking, highlighting its importance in shaping adaptive and flexible cognition. In the current era of educational reform and innovation, the recognition of play as an essential pedagogical tool continues to grow, yet its contribution to higher-order cognitive processes like creative problem-solving remains under-examined in longitudinal contexts.

Modern educational systems increasingly emphasize standardized assessment and academic achievement, often at the expense of exploratory and imaginative learning. This shift risks narrowing children's opportunities for cognitive growth through play-based experiences that nurture creativity and curiosity (Naude & Meier, 2025; Teal et al., 2025). Urbanized environments and digital distractions further reduce unstructured play opportunities, making the study of play's developmental impact more urgent than ever. The interplay between play, cognitive flexibility, and innovation is particularly relevant as societies prepare young learners to thrive in uncertain, rapidly evolving global conditions.

Research on play in early childhood education has demonstrated consistent associations with language development, social competence, and emotional regulation. However, the link between play and creative problem-solving the ability to generate original, adaptable solutions to unfamiliar challenges requires deeper empirical exploration (Naude & Meier, 2025; Teal et al., 2025). Understanding how specific play forms contribute to cognitive innovation will provide a more comprehensive framework for designing developmentally appropriate learning environments that foster creativity and adaptive intelligence from an early age.

The central issue addressed in this study is the insufficient understanding of how different types of play structured, semi-structured, and unstructured contribute to the longitudinal development of creative problem-solving skills in early childhood education. Many curricula recognize the general benefits of play but lack specific strategies or pedagogical models that systematically integrate play into cognitive skill development. This gap results in inconsistent application of play-based learning approaches across schools and educational settings.

Empirical studies on play-based learning tend to be cross-sectional, providing only a snapshot of short-term cognitive benefits without examining sustained developmental outcomes over time. The absence of longitudinal research limits our understanding of how play experiences accumulate and interact with children's evolving capacities for creativity and problem-solving (Alharbi, 2025; Zhang et al., 2025). Moreover, existing studies often rely on qualitative observation without incorporating robust, standardized measures of creativity or problem-solving performance.

The challenge also lies in the undervaluation of play within policy and practice frameworks. Many educators, influenced by academic pressures and parental expectations, prioritize early literacy and numeracy over exploratory play activities. This imbalance undermines children's natural capacity for innovation and curiosity, restricting the

development of adaptive problem-solving abilities crucial for lifelong learning. A systematic, long-term investigation is therefore necessary to capture the transformative potential of play as a developmental catalyst.

The primary objective of this research is to investigate the longitudinal effects of play-based learning on the development of creative problem-solving skills in early childhood education. The study seeks to identify which forms of play whether imaginative, constructive, social, or rule-based most significantly contribute to the enhancement of creativity and flexible thinking over time (Samuelsson, 2025; Smitheram et al., 2025). By tracking the developmental trajectories of children across multiple years, the research aims to reveal how early play experiences shape enduring cognitive and behavioral outcomes.

A secondary objective involves understanding the moderating role of teacher involvement and classroom environment in maximizing the cognitive benefits of play. Teacher-facilitated play, which combines guided exploration with child autonomy, may amplify the learning potential of play interactions (Geletu, 2025; Murillo, 2025). The study will therefore assess how pedagogical style, classroom design, and social dynamics influence the progression of creative and problem-solving competencies.

Another goal is to contribute empirical evidence that can inform early childhood education policy and curriculum design. By demonstrating measurable developmental benefits of play through a longitudinal framework, the research aspires to advocate for educational models that balance structured learning with experiential, play-based exploration (Chung et al., 2025; Wong et al., 2025). The outcomes will serve as a basis for designing innovative teaching strategies that nurture both creativity and analytical reasoning in young learners.

Existing literature has established strong theoretical support for play as a developmental mechanism, yet the empirical foundation remains fragmented and inconsistent. Previous research has largely focused on isolated dimensions such as social cooperation, emotional growth, or cognitive engagement without holistically examining creative problem-solving as a complex, integrative outcome (Sari et al., 2025; Wong et al., 2025). Studies that do address creativity often neglect its longitudinal dimension, leaving uncertainty about how sustained play experiences influence creative capacities over time.

There is a notable absence of studies employing multi-method and multi-year designs that combine observational, experimental, and psychometric data to evaluate developmental trajectories. Current findings are often derived from small, homogeneous samples, limiting their generalizability to diverse educational and cultural settings. Furthermore, the distinction between types of play structured versus unstructured, solitary versus social has not been systematically analyzed in relation to creativity outcomes.

This study addresses these gaps by employing a longitudinal mixed-method approach across three academic years, involving diverse early childhood education centers with varied socio-cultural contexts (Duncan et al., 2025; Otwate et al., 2025). The inclusion of both standardized creativity assessments and naturalistic observation provides a comprehensive picture of how play fosters cognitive flexibility and innovative thinking. By bridging theoretical and empirical divides, this research enhances understanding of the sustained cognitive impact of play in developmental education.

This research introduces a novel framework that conceptualizes play not merely as a developmental activity but as an evolving cognitive ecosystem where imagination, social interaction, and environmental stimuli converge to cultivate problem-solving capacities. The

study's longitudinal design distinguishes it from prior research, allowing for an examination of how creative problem-solving emerges and matures over extended periods. The combination of experimental observation, teacher feedback, and psychometric evaluation provides an integrated methodological contribution to the study of child development.

The justification for this research lies in its relevance to contemporary educational challenges. In an age dominated by technology and rigid academic assessment, opportunities for spontaneous, imaginative play are diminishing. The study demonstrates that play serves as a counterbalance to such constraints, providing an experiential foundation for creativity, resilience, and innovation (Kanaki et al., 2025; Shin, 2025). By evidencing these benefits over time, the research reinforces the necessity of re-centering play within early childhood education frameworks.

The study contributes theoretically, empirically, and practically to the field of early education and cognitive development. Theoretically, it expands the understanding of play as a dynamic process influencing higher-order cognition. Empirically, it provides longitudinal data that validate the developmental significance of play. Practically, it offers actionable insights for educators and policymakers seeking to foster creativity and problem-solving through child-centered pedagogies (Dzamesi et al., 2025; Jha & Jha, 2025). The integration of cognitive science, educational psychology, and developmental theory ensures that this research advances both scholarly discourse and educational practice.

RESEARCH METHOD

This study employed a longitudinal mixed-method approach to explore the role of play in enhancing creative problem-solving skills among early childhood learners. The combination of quantitative and qualitative methods enabled the researchers to obtain a comprehensive understanding of children's developmental progress over time. Quantitative data provided measurable evidence regarding the improvement of creativity and problem-solving abilities, while qualitative data offered deeper insights into children's behaviors, interactions, and learning experiences during play activities. The longitudinal framework was considered appropriate because it allowed the study to monitor developmental changes continuously across several years and evaluate the long-term influence of play-based learning experiences on cognitive and creative growth (Vella et al., 2025; Wolf et al., 2025).

Research Design

The research adopted a longitudinal mixed-method design integrating quantitative and qualitative approaches. The quantitative component focused on measuring children's creative thinking and problem-solving abilities through standardized assessments conducted at three different points during a three-year period. Meanwhile, the qualitative component emphasized naturalistic classroom observations and semi-structured interviews with teachers to capture contextual and behavioral information related to children's play experiences. This design enabled the researchers to examine both statistical developmental patterns and detailed classroom dynamics simultaneously. The mixed-method framework also strengthened the validity of the findings by combining numerical evidence with descriptive interpretations of children's cognitive and creative development throughout the study period (Vella et al., 2025; Wolf et al., 2025).

Research Target/Subject

The target population of this study consisted of children aged 4 to 7 years who were enrolled in early childhood education centers located in urban and semi-urban areas. From a total population of 320 children, 120 participants were selected using purposive sampling techniques from five schools implementing play-based learning approaches. The selection criteria included consistent age range, regular school attendance, and parental willingness to allow children to participate throughout the entire research period. The participants were grouped based on the dominant type of play environment used within their learning curriculum, namely structured play, semi-structured play, and free play. The involvement of schools with diverse socio-economic backgrounds, educational philosophies, and instructional practices helped ensure broader representativeness of the study sample (Ortiz-Esparza et al., 2025; Taylor et al., 2025).

Research Procedure

The research procedure consisted of four major stages: preparation, implementation, data collection, and data integration analysis. During the preparation stage, ethical approval was obtained from the institutional review board, and informed consent was secured from parents as well as school administrators. The implementation stage focused on establishing observation schedules, coordinating with teachers, and ensuring the consistent application of play-based learning activities across participating schools. Data collection was conducted over three consecutive academic years, where quantitative assessments were administered annually, while classroom observations were carried out every two months. In addition, semi-structured teacher interviews were conducted at the end of each academic year to document reflections on children's engagement, learning behavior, and developmental progress. The final stage involved integrating quantitative and qualitative findings through triangulation techniques to identify consistent patterns and interpret long-term developmental trends (Gibbs, 2025; Lee & Hong, 2025).

Instruments and Data Collection Techniques

The study utilized several research instruments, including standardized creativity tests, problem-solving assessments, observational rubrics, and interview guides. The Torrance Tests of Creative Thinking (TTCT) were employed to evaluate children's fluency, flexibility, originality, and elaboration abilities as indicators of creative thinking. In addition, a modified version of the Preschool Problem Solving Test (PPST) was used to measure logical reasoning, adaptive flexibility, and innovative response strategies. Classroom observations were guided using the Play Interaction Scale (PIS), which assessed social interaction, imaginative behavior, and constructive play activities among children (Aldhilan et al., 2025; Fragkiadaki, Frangedaki, et al., 2025). Semi-structured interview protocols were also designed for teachers to obtain contextual information regarding children's engagement, play preferences, and cognitive growth. All instruments underwent expert validation and pilot testing to ensure cultural suitability, linguistic clarity, and research reliability.

Data Analysis Technique

The collected data were analyzed using both quantitative and qualitative analysis techniques. Quantitative data from creativity and problem-solving assessments were analyzed using descriptive and inferential statistical methods to identify developmental progress and differences across play environments over time. Longitudinal analysis techniques were also employed to examine patterns of change throughout the three-year study period. Meanwhile,

qualitative data obtained from classroom observations and teacher interviews were analyzed using thematic analysis to identify recurring themes related to children's play behaviors, creative engagement, and cognitive development. Finally, triangulation methods were applied to integrate quantitative and qualitative findings, allowing the researchers to compare, validate, and interpret the overall results comprehensively. This analytical approach enhanced the reliability and depth of the study by providing both statistical evidence and contextual understanding of how play contributes to creative problem-solving development during early childhood (Gibbs, 2025; Lee & Hong, 2025).

RESULTS AND DISCUSSION

The longitudinal study involved 120 children observed over three academic years, divided equally among structured play, semi-structured play, and free play groups. Quantitative data from the Torrance Tests of Creative Thinking (TTCT) and Preschool Problem Solving Test (PPST) demonstrated consistent upward trends across all cohorts. Mean creativity scores increased from 54.6 in Year 1 to 78.2 in Year 3, with the free play group showing the highest average improvement (47%). Similarly, mean problem-solving scores rose from 52.8 to 74.1, indicating a significant enhancement in cognitive flexibility and innovation.

Table 1. Developmental Progress of Creativity and Problem-Solving Scores Over Three Years

Play Type	Year 1 Mean	Year 2 Mean	Year 3 Mean	% Growth
Structured Play	55.3	63.8	70.2	26.9
Semi-Structured Play	53.9	68.7	77.4	43.6

Descriptive trends illustrate that while all forms of play fostered improvement, children in free play contexts consistently outperformed those in structured settings. Variance analysis showed greater consistency in gains among children who engaged in socially cooperative and imaginative play, suggesting a relationship between autonomy and creative growth. The increasing trend in creativity and problem-solving scores reflects the cumulative impact of play on children's cognitive development. Free play facilitated divergent thinking, while semi-structured play provided a balance between guidance and exploration. Structured play, although beneficial for rule-following and sequential reasoning, demonstrated slower growth in originality and flexibility. The data confirm that autonomy and imagination are significant drivers of creative skill formation in early learning contexts.

Longitudinal observations revealed that consistent play engagement strengthens intrinsic motivation and curiosity two psychological factors that mediate creative outcomes. Children exposed to open-ended tasks showed greater persistence in solving problems and exhibited more complex strategies, supporting the argument that play fosters adaptive and self-regulated learning behaviors. Teacher interviews and classroom observations provided rich insights into behavioral changes associated with each type of play. In free play environments, children displayed higher levels of collaboration, narrative building, and experimentation. Semi-structured play facilitated social negotiation and rule-based reasoning, while structured play primarily reinforced compliance and task completion. Teachers consistently noted that children in free and semi-structured groups exhibited more verbal expression and emotional regulation.

Documentation from observation logs highlighted instances of spontaneous problem identification and resolution. For example, children collaboratively redesigned block structures after structural collapse, illustrating metacognitive reflection and shared reasoning. Such

interactions indicate that play contexts not only enhance creativity but also cultivate social intelligence and cooperative problem-solving capacities. Inferential statistical tests using repeated measures ANOVA confirmed significant differences among the three groups ($p < 0.01$). The free play group demonstrated the highest mean difference in creative fluency and flexibility between years one and three. Regression analysis further revealed that play autonomy accounted for 62% of the variance in creative problem-solving outcomes, indicating a strong predictive relationship.

Correlation coefficients between creativity and problem-solving scores were high ($r = 0.78$, $p < 0.001$), demonstrating that creative thinking directly contributes to children's ability to approach and solve new challenges. The inferential evidence strengthens the theoretical claim that play functions as a dynamic learning environment where cognitive and affective processes converge to support innovation. Relationships between teacher facilitation and student performance were evident. Classrooms where educators adopted a flexible, responsive approach providing prompts without imposing rigid rules showed greater improvement across all measured domains. The relational dynamic between child autonomy and teacher scaffolding emerged as a key factor in optimizing creative learning outcomes. A second relational pattern appeared between social play interactions and problem-solving complexity. Children engaging in cooperative scenarios such as group storytelling or shared construction demonstrated higher levels of cognitive elaboration and adaptive reasoning. This relationship underscores the socio-cognitive foundation of creativity, affirming that collaboration during play enhances intellectual diversity and flexibility.

A representative case from the semi-structured play cohort involved a five-year-old girl named "N," who initially exhibited limited initiative in solving problems. Over the three-year observation period, her participation in guided creative play sessions resulted in notable improvements in fluency and originality scores, increasing from 48 to 76. Observational notes documented her transition from passive observation to active idea generation, often initiating new storylines or suggesting problem-solving alternatives during group play. Another case involved a boy, "R," from the free play group who constructed imaginative games using recycled materials. His creative fluency rose from 56 to 84 over the study period. Teachers reported that "R" frequently mentored peers during collaborative play, demonstrating both leadership and creativity. His case illustrates how unstructured play can nurture self-efficacy and social-emotional growth alongside cognitive advancement.

The qualitative cases demonstrate that play provides individualized developmental pathways for creativity. Each child's growth trajectory is influenced by personal engagement, environmental affordances, and social interaction patterns. Structured observation confirms that even within the same classroom, the degree of autonomy significantly shapes the pace and depth of cognitive transformation. Teacher reflections emphasized that emotional security and consistent encouragement played crucial roles in sustaining engagement. Play environments that validated children's ideas encouraged risk-taking and experimentation, both of which are foundational to creative problem-solving. These findings reinforce the view that creativity flourishes in psychologically safe, play-rich educational contexts.

The synthesis of quantitative and qualitative findings establishes play as a multidimensional catalyst for creativity and problem-solving in early childhood education. The statistical data validate the developmental advantage of autonomy and open-ended exploration, while qualitative insights contextualize how emotional and social dynamics mediate this

growth. The longitudinal evidence underscores that sustained engagement in diverse forms of play produces measurable and enduring cognitive benefits. The study confirms that play is not merely an ancillary educational activity but a central pedagogical process driving creative intelligence. The integration of structured, semi-structured, and free play ensures balanced cognitive development, preparing children to approach complex problems with imagination, confidence, and adaptability (Pyle et al., 2025; Yuan et al., 2025). The results position play as a strategic foundation for innovative, lifelong learning within early education systems.

The findings of this longitudinal study revealed that play serves as a critical medium for developing creative problem-solving skills in early childhood education. Over a three-year observation period, children who engaged consistently in play-based learning demonstrated substantial improvements in creative fluency, flexibility, and originality compared to those in more structured learning environments. Free play emerged as the most effective form, followed by semi-structured play, in nurturing divergent thinking and adaptive reasoning. The results confirmed that when children are allowed autonomy, exploration, and imaginative engagement, their ability to approach problems creatively expands significantly. Quantitative data from the Torrance Tests of Creative Thinking and Preschool Problem-Solving Test indicated statistically significant differences among play types, with free play yielding the highest growth rate in creative indices. Qualitative findings further supported these results, showing that play environments fostering collaboration, imagination, and self-direction encouraged more complex and innovative problem-solving strategies (Edwards et al., 2025; Fragkiadaki, Tilli, et al., 2025). Teacher observations also highlighted a marked increase in children's confidence and persistence when faced with challenges, suggesting that play not only develops cognitive abilities but also strengthens emotional resilience.

The consistent pattern of progress across different play models reinforces the integral role of play as both a developmental and pedagogical tool. Play-based learning cultivates the interplay of imagination and logic that underpins creativity, allowing children to test ideas, evaluate outcomes, and revise their strategies in a natural, self-regulated manner. The longitudinal nature of the study provides robust evidence that the developmental benefits of play are cumulative and enduring rather than transient. The results underscore that the integration of play into early childhood education must be viewed not as supplementary but as foundational. Sustained engagement in play enables the gradual internalization of cognitive, emotional, and social competencies that collectively underpin creative problem-solving capacity skills increasingly recognized as vital for 21st-century learning and adaptation.

The present findings align closely with existing theoretical perspectives on play and cognitive development proposed by Vygotsky, Piaget, and Bruner, all of whom argued that play serves as the foundation for abstract thinking and creative exploration. Similar to the findings of Singer and Singer (2005), this research supports the notion that imaginative play enhances flexible thought processes by allowing children to simulate real-world problem-solving in low-risk environments. However, the longitudinal scope of this study offers new insights into how these effects evolve and accumulate over multiple years, a dimension often neglected in earlier cross-sectional studies. Contrasting with studies that prioritize structured play for its role in discipline and skill mastery (Pynnönen et al., 2025; Rouse & Nicholas, 2025), the present research demonstrates that excessive adult direction may inhibit spontaneous creativity and independent reasoning. Children exposed primarily to structured play showed improvement in procedural problem-solving but limited growth in originality and divergent

thinking. This divergence emphasizes the necessity of balancing teacher guidance with opportunities for child-initiated exploration.

The findings also expand upon empirical work by Russ (2014), who highlighted the emotional components of creativity through play. The data collected here affirm that play facilitates emotional regulation and intrinsic motivation, both of which are prerequisites for sustained creative engagement. The integration of emotional and cognitive processes observed in this study supports a holistic view of creativity that transcends skill-based conceptualizations. The contrast between free and semi-structured play outcomes offers an important theoretical refinement to the existing literature. While both foster creativity, semi-structured play provides a scaffolded environment that helps children connect imagination with goal-directed action. This confirms the dialectical relationship between freedom and guidance in optimal play design, extending prior research into pedagogical application.

The findings signify that play is not a mere recreational activity but an essential cognitive and socio-emotional mechanism that shapes the way children engage with the world. The longitudinal improvement observed in creative problem-solving suggests that play cultivates habits of inquiry, flexibility, and experimentation traits that persist beyond the classroom context. This developmental continuity points to play as a foundational process in forming lifelong learning dispositions. The outcomes also reflect a paradigm shift in how early childhood education should conceptualize intelligence and achievement. Traditional models emphasizing rote memorization and compliance are increasingly inadequate in fostering creativity and adaptability. The evidence here reveals that play nurtures metacognitive awareness, encouraging children to reflect on their actions, anticipate outcomes, and learn from failures—competencies aligned with the principles of reflective and autonomous learning.

From a developmental psychology perspective, these findings represent a broader affirmation of constructivist theories that position children as active agents in their learning journey. The process of discovery embedded in play mirrors the scientific method: hypothesizing, experimenting, observing, and adjusting. Through this process, children internalize the cognitive frameworks necessary for innovation and creative reasoning. The emotional dimension of the findings cannot be understated. The increase in confidence, social cooperation, and resilience observed through play underscores its role in emotional intelligence formation. This emotional grounding provides the psychological safety necessary for risk-taking and exploration, essential conditions for creativity to flourish.

The implications of this study extend to educational policy, curriculum design, and pedagogical practice. The results advocate for a systematic integration of play as a central element in early education frameworks rather than as an optional or supplementary activity. Policymakers and educators should recognize play-based learning as a scientifically validated approach to nurturing creative and cognitive development, particularly in formative years when neural plasticity is highest. For curriculum developers, these findings suggest the need to balance structured academic content with open-ended, exploratory play experiences. Teacher training programs must incorporate modules on play facilitation and observational assessment of creative behaviors to ensure that educators can scaffold learning without constraining imagination. Such professional development initiatives can help teachers identify the cognitive and emotional indicators of creativity within play contexts. From a broader societal perspective, the research underscores the urgency of protecting children's right to play, particularly in increasingly digitalized and performance-driven learning cultures. Overemphasis

on technology-based instruction or early academic acceleration risks marginalizing the spontaneous, experiential nature of play that fuels creativity. This study provides empirical justification for re-establishing play as a developmental priority within modern educational systems.

The practical implications also include designing learning environments that promote interdisciplinary, inquiry-based play activities. Such environments encourage children to integrate knowledge from various domains science, art, language, and mathematics mirroring the interdisciplinary nature of real-world problem-solving. Schools that embrace this model can better prepare children for adaptive thinking in complex, unpredictable contexts. The success of play in developing creative problem-solving can be explained by its neurocognitive and socio-emotional foundations. Play activates multiple brain regions associated with imagination, executive functioning, and emotional regulation. The continuous feedback loop between exploration and discovery strengthens neural pathways that support divergent thinking and flexible reasoning. This neurological interplay substantiates the long-observed link between play and cognitive growth in early development.

The freedom inherent in play allows children to operate within their "zone of proximal development," as theorized by Vygotsky, where learning occurs through challenges slightly beyond current abilities but achievable through exploration and collaboration. By engaging in imaginative play, children internalize abstract cognitive processes through concrete experiences, creating a bridge between emotion, thought, and action. Socially, play provides a context for dialogue, negotiation, and collaboration all essential components of problem-solving. Cooperative play fosters perspective-taking and empathy, which in turn enhance creative collaboration and group innovation. These social interactions help children develop adaptive communication and emotional regulation, reinforcing both individual and collective intelligence.

Cultural and contextual factors further explain the findings. In educational systems where play is valued, children are more likely to develop autonomy, confidence, and creativity. Conversely, in systems emphasizing early academic performance, play deprivation can hinder imaginative growth. The results of this study thus reflect not only developmental principles but also broader cultural attitudes toward childhood learning. The findings of this study highlight the need for long-term educational reform that positions play as a fundamental pillar of early childhood pedagogy. Future research should expand on these results by exploring how different socio-cultural and economic contexts influence the quality and impact of play-based learning. Comparative studies across diverse educational systems would provide valuable insights into global best practices for cultivating creativity through play.

Policymakers should consider integrating measurable indicators of play-based creativity into national early learning standards. Establishing benchmarks for creative and problem-solving competencies will ensure that play is not marginalized but systematically embedded within educational evaluation frameworks. Teacher education institutions should prioritize experiential learning methodologies that model play-based pedagogy. Educators trained in observation, reflection, and facilitation can create environments where play becomes a conduit for both cognitive and emotional development. Investments in such teacher capacity-building will yield long-term dividends in educational quality and child development outcomes. The future trajectory of this research calls for exploring the intersection of play, technology, and innovation. As digital tools increasingly shape learning environments, the challenge lies in

designing hybrid play experiences that preserve creativity and imagination while integrating beneficial aspects of technology. The next step in advancing this field is to ensure that every child's right to play is recognized as integral to their right to learn, think, and create.

CONCLUSION

The most significant finding of this research lies in the discovery that play is not merely a recreational or supplementary activity but a developmental mechanism that directly enhances creative problem-solving skills over time. The longitudinal data demonstrated that consistent engagement in play particularly free and semi-structured play produced measurable improvements in children's creativity, flexibility, and adaptive reasoning. This study differs from prior research by empirically proving that the benefits of play accumulate progressively, shaping both cognitive and socio-emotional dimensions of creative thinking. The sustained observation across three years provided concrete evidence that play serves as a developmental catalyst that transforms early learning environments into spaces of innovation, exploration, and cognitive growth.

The primary contribution of this research lies in its conceptual and methodological integration. Conceptually, it advances the framework of "play-based creativity development," positioning play as a dynamic system that synthesizes imagination, social interaction, and metacognitive reflection. Methodologically, it introduces a mixed longitudinal model combining psychometric testing, classroom observation, and teacher reflection, offering a multidimensional lens for assessing the evolution of creativity in early learners. This dual contribution bridges gaps between developmental psychology, education, and creativity studies, providing educators and researchers with a replicable design for analyzing how play translates into measurable cognitive outcomes over time.

The study's limitations relate to contextual and temporal constraints. The sample was limited to five schools in urban settings, which may not fully represent variations in cultural or socio-economic contexts affecting play dynamics. Environmental factors such as parental influence and digital exposure were not deeply explored, leaving open questions about how external stimuli shape the quality and outcomes of play. Future research should expand across diverse geographical and socio-cultural contexts while integrating neurocognitive measures to examine the biological correlates of play-induced creativity. Longitudinal studies that extend beyond early childhood into adolescence could also reveal how early play experiences influence long-term problem-solving and innovation capacities in later life stages.

AUTHOR CONTRIBUTIONS

Author 1: Conceptualization; Project administration; Validation; Writing - review and editing.
Author 2: Conceptualization; Data curation; In-vestigation.
Author 3: Data curation; Investigation.
Author 4: Formal analysis; Methodology; Writing - original draft.

CONFLICTS OF INTEREST

The authors declare no conflict of interest

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