Article

Study on the Placement and Support of Loose Parts in Kindergarten Construction Area

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Abstract: The placement and use of loose parts in the construction area has received greater attention. This study explored the current situation of loose parts in kindergarten construction areas based on social construction theory and gamified learning theory through questionnaires (130 teachers) and interviews (10 teachers). The study found that teachers identified loose parts primarily by emphasizing manipulability, malleability, and variety, while valuing their dual advantages: promoting child development and enhancing instructional efficiency. Teachers' motivation to use loose parts has both internal and external factors. Although teachers actively use diverse materials and develop structured implementation plans to support children's development, many challenges remain. These challenges included insufficient child engagement, difficulty maintaining deep exploration, and a mismatch between program goals and children's spontaneous activities. Teachers used multidimensional adjustment strategies, particularly through group discussions to dynamically adjust the selection of instructional materials, layout, and the way activities were guided. Based on these findings, we make 4 targeted recommendations: layering progressive material design to enhance complexity; implementing dynamic individualized adjustments; rooting instructional planning in teachers' intrinsic motivation; and constructing an actionable construct framework.

Keywords: loose parts; construction area; placement; support

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1. Introduction

Loose parts, with their natural affinity, cost-effectiveness, multi-functional versatility, adaptability, and ease of assembly, are becoming essential resources for kindergarten area activities. These materials, characterized by open-ended structures and diverse play possibilities, are widely recognized as key catalysts for stimulating children's creative thinking [1,2]. Given the unique nature of early childhood learning, providing abundant manipulable materials to support exploration aligns perfectly with this requirement. Their everyday accessibility (such as cardboard boxes, wood, plastic bottle) not only reduces educational costs but also facilitates deep learning through infinite combination possibilities. Research confirms that materials used in the construction area can effectively cultivate cognitive abilities, problem-solving skills, and social-emotional competence by providing hands-on, interactive opportunities for children to engage with diverse materials [3,4]. Teachers' positive intervention on loose parts can enhance children's well-being [5].

However, significant practical challenges persist. While educators generally acknowledge the value of loose parts, implementation faces three major obstacles. First, ambiguous motivation: Some teachers admit that materials are primarily used for administrative tasks rather than educational purposes, creating a disconnect between the materials and curriculum goals [6]. Second, fragmented execution: Materials are often haphazardly distributed across areas without systematic design tailored to construction zone needs [7]. Third, superficial support: Teachers lack effective strategies to address issues

like waning interest and difficulties in transferring experiences [8]. These challenges reveal deeper problems: insufficient implicit understanding of educational objectives regarding loose parts and vague logic in tiered deployment, resulting in materials being limited to basic operational use.

Furthermore, current research reveals significant gaps. Systematic empirical studies focusing on the construct zone remain insufficient, with most existing work remaining at the level of strategy descriptions [9]. Particularly lacking are in-depth explorations of the motivation chain (from conceptual understanding to effect evaluation) and dynamic support mechanisms. By deconstructing the cognitive-motivational-behavioral-support process, this study aims to address three core questions: How do teachers comprehend the core value of loose parts within the construct zone? What key factors influence instructional deployment decisions? How can sustainable support systems be established?

2. Method

2.1. Participants

In order to understand the current status of low-structural material placement and use in the kindergarten construction area, this study identified kindergarten teachers as the research subjects. 130 questionnaires were distributed to kindergarten teachers, and the researcher selected a total of 10 kindergarten teachers for interviews using purpose sampling.

2.2. Procedure

This study utilizes both questionnaire surveys and interviews to gather comprehensive data. The questionnaire method helps to understand kindergarten teachers' comprehension of loose parts and their implementation in construction activity areas, including the basic support measures they adopt. Through interviews, we explore teachers' motivations and practical strategies for material deployment, gathering valuable insights from frontline educators. Informed consent was obtained from all participating kindergarten teachers prior to data collection to ensure ethical standards were met.

2.3. Measures

Drawing on existing research and expert recommendations, we developed a questionnaire for evaluating the provision and utilization of loose parts in kindergarten construction zones. The questionnaire development process involved three phases: preliminary compilation, revision and validation, and distribution. This study aimed to assess kindergarten teachers 'perceptions of loose parts, their current practices in material distribution and usage, challenges encountered, and strategies for effective utilization in construction zone environments. The Cronbach's alpha coefficient of 0.92 and the KMO value of 0.874 indicate that the survey demonstrates high reliability and validity.

The interview aims to investigate kindergarten teachers 'specific practices in providing loose parts for construction zones, their motivations and strategies, as well as the subsequent follow-up work and outcomes. Ten kindergarten teachers were selected for semi-structured interviews. The interview outline focused on three key aspects: the provision of loose parts in construction zones, teachers' motivations and strategies, and the effectiveness and challenges of material provision. The interview implementation process included a pilot interview and formal interviews: A pilot interview was conducted with one teacher, whose feedback was used to revise the interview outline and wording. After discussions with the supervisor, a finalized interview outline was developed for the formal interviews with all ten teachers.

2.4. Data Analysis Methods

This study employs a combined quantitative and qualitative analytical approach. For questionnaire analysis, databases were created using EXCEL and SPSS20.0 software packages for statistical processing. Categorical data were analyzed through descriptive statistics including frequency, percentages, mean values, and standard deviations. Multiple-choice questions were examined using multiple response analysis, while single-choice items underwent chi-square tests. Itemized questionnaires were analyzed using ANOVA for inferential statistics. In interview analysis, data was processed through a bottom-up approach. Content analysis identified recurring themes in qualitative texts, with key information extracted to form five coded dimensions: "Kindergarten teachers' understanding of loose parts' concepts and values," "Current implementation status of loose parts in construction areas," "Motivations and preparation plans for loose parts deployment in construction areas," "Implementation outcomes and challenges of loose parts in construction areas," and "Strategies and recommendations for utilizing loose parts in construction areas." These coding dimensions align with the research objectives.

3. Results

3.1. Understanding the Concept and Value of Loose Parts

3.1.1. Focuses on the Inherent Characteristics of Loose Parts

Preschool teachers 'understanding of loose parts primarily manifests through their distinctive features, particularly their operationality, plasticity, and variability. Kindergarten educators emphasize hands-on manipulation of these materials, such as free play, diverse activities, in-depth exploration, and strong malleability. Both low-structure and high-structure materials are essential in kindergarten area activities, and comparing these two categories reveals teachers' comprehension of loose parts. Through comparison with high-structure materials, educators highlight the exploratory and flexible nature of loose parts, recognizing their impact on children's creativity. When designing questions like "What do you consider loose parts to be?" based on core concepts, the chi-square test showed a significant P-value (0.000***), indicating statistical significance with a $P \leq 0.05$. The distribution showed uneven representation: "materials for free manipulation" (18.8%) ranked first, followed by "materials with flexible usage" (17.5%) and "operational materials for deeper exploration" (15.4%). Preschool teachers recognize loose parts' structural simplicity, diverse applications, and investigative value, while also valuing their practicality, daily relevance, and adaptability. This demonstrates educators 'fundamental understanding of loose parts' conceptual characteristics. The interview data analysis reveals kindergarten teachers 'concrete understanding of loose parts' characteristics: They identify five key attributes. First, these materials are "found in daily life and sourced from discarded items," demonstrating practical relevance. Second, their "simple design and minimal structural complexity" reflect operational ease. Third, the "freedom to assemble and manipulate" grants children autonomy to adapt materials according to their ideas, offering flexible play without rigid rules. Fourth, their "high malleability, adaptable nature, and exploration potential" highlight variability. Fifth, their "versatile placement across different activity areas" ensures universal applicability. Notably, one teacher observed that these materials carry "more implicit educational objectives." Teachers categorize loose parts into five types—discarded materials, semi-finished products, natural materials, non-natural materials, and household items—with some overlap between categories.

3.1.2. Focus on the Value of Loose Parts to Different Subjects

This understanding manifests in two key dimensions: early childhood development and teaching practices. Regarding child development, Preschool teachers recognize the fun and practicality of loose parts as catalysts for imagination and creativity, which foster

divergent thinking and autonomy. In terms of teaching, these materials are valued for their ability to enrich classroom activities while being time-efficient, cost-effective, and easily accessible. When asked "What advantages do you think loose parts offer?", the most common responses were: "Stimulates children's imagination and creativity" (24.2%), "Provides space for free exploration" (21.2%), "Develops divergent thinking" (15.8%), and "Enhances self-directed material organization" (15.4%). Interview data analysis reveals that kindergarten teachers clearly recognize the value of loose parts. They particularly emphasize these materials 'unique benefits in creating exploratory environments and nurturing operational independence. Teachers also highlight their significant impact on developing children's capabilities and cognitive development. These materials inherently carry significant educational value, particularly in fostering creativity, independence, and problem-solving skills. To deepen understanding, The questionnaire was expanded to confirm that loose parts benefit both children's development and educators' professional practice. For children's development, loose parts can 'provide space for free exploration, spark their interest, stimulate curiosity, enhance creativity, enrich play experiences, and develop practical problem-solving and fine motor skills'. For teachers' work, these materials can "enrich classroom interactions and activity materials" while being "durable, easy to obtain, time-saving, and cost-effective".

3.2. Current Situation of the Placement and Support of Loose Parts in Construction Area

3.2.1. The Behavior and Intention of Loose Parts Delivery in Construction Area

This study investigates the distribution of loose parts across kindergarten activity areas, revealing that teachers consistently allocate these materials to construction, art, and cognitive development zones. The widespread use of loose parts across different areas highlights their adaptability and broad applicability in fostering various developmental skills. Notably, the highest allocation rates (24%) were observed in construction zones, followed by art zones (19.5%) and cognitive development zones (17.1%), highlighting their strategic importance. Behavioral analysis through the question "Which areas have you distributed loose parts?" revealed significant regional variations: construction zones received the most materials, followed by art zones (19.5%) and cognitive development zones (17.1%). Interviews with 10 teachers confirmed this pattern. Teachers predominantly preferred construction zones for material placement, though all designated areas suitable for loose parts were concentrated in construction, art, and cognitive development zones, with construction being the primary focus.

3.2.2. The Types and Reasons of Loose Parts in Construction Area

After gaining preliminary understanding of loose parts 'distribution in the construction area, researchers sought to clarify their specific deployment patterns. Interviews revealed that kindergarten teachers demonstrate strong initiative in deploying these materials, with diverse types including recycled materials, construction materials, natural materials, and play materials. Recycled materials include plastic bottles, cardboard boxes, shredded paper, and other everyday items like potato chip containers, milk powder cans, and aluminum cans. Construction materials feature mortise-and-tenon joints, magnetic tiles, building blocks, Lego connectors, and pipes. Natural materials include leaves and seashells, while play materials consist of playing cards, coins, game tokens, mahjong tiles, and paper clay. These open-ended loose parts are typically supplemented with auxiliary components. Teachers select materials based on several considerations: Firstly, the inherent advantages of loose parts—simple design, high malleability, flexible usage, and the ability to create personalized structures with decorative elements. Secondly, their role in fostering children's development through guided exploration and imaginative expression. Thirdly, thematic integration, such as incorporating mortise-and-tenon joints into cultural heritage-themed activities.

3.2.3. The Motivation and Plan for the Delivery of Loose Parts in Construction Area

The purpose of kindergarten teachers distributing loose parts in construction areas primarily aims to promote the development of specific children's abilities, influenced by other motivational factors such as facilitating teaching activities and replenishing area supplies. As a key zone for distributing loose parts, the motivations behind this practice cannot be overlooked. Frequency analysis reveals uneven distribution of options: "promoting the development of children's specific abilities" was selected 32 times, accounting for the highest proportion at 40%. The options "facilitating teaching activities" and "supplementing loose parts" also received significant attention, each with 16.25% selection frequency. Teachers 'motivations for distributing loose parts stem from both internal and external factors, requiring comprehensive consideration of their origins to establish clearer objectives. Interview coding results from kindergarten construction area materials reveal diverse motivations, including external factors like "teaching task arrangements" and internal considerations such as "enhancing children's construction skills, promoting individualized development, aligning with children's abilities and age groups, accumulating experiential knowledge, breaking conventional constraints, supporting thematic activities, and providing abundant learning resources." The findings indicate that internal developmental motivations remain the primary focus. Based on these motivations, kindergarten teachers develop corresponding preparations and plans. Regarding material preparation, kindergarten teachers conduct the following preparatory work: "assessing material suitability (including safety, diversity, hierarchical structure, and compatibility); investigating children's interest in materials; adjusting construction area layouts; preparing environmental elements; and anticipating activities based on exemplary models." They also develop phased activity plans: in the preparatory phase, they establish building themes, guide children in material exploration and preliminary planning; during the implementation phase, they encourage creative construction through discussions and adjustments based on children's responses; in the follow-up phase, they organize class-wide sharing sessions with evaluations, enabling children to complete comprehensive explorations.

3.2.4. The Placement and Support Dilemma of Loose Parts in Construction Area

Through analyzing the effectiveness and challenges of loose parts in kindergarten construction zones, we observed positive outcomes with children showing strong engagement and enthusiasm. Some children's responses even exceeded expectations, with improved performance after extended exploration. However, individual differences emerged: "Some children enthusiastically apply materials directly in constructions, while others observe peers' usage before adapting it to their own projects." This necessitates contextualized implementation that takes into account children's developmental stages and learning preferences to create tailored educational approaches. Teachers faced three primary challenges: a lack of sustained interest, leading to superficial engagement; difficulties in guiding children with unfamiliar materials; and barriers to promoting deeper exploration and skill development. Additionally, challenges included implementing activity plans and discrepancies between theoretical designs and actual conditions, as well as material organization and substitute provision. These challenges arise primarily from four key factors: child dynamics, material selection, instructional planning, and environmental adaptation. To investigate the challenges faced by kindergarten teachers in providing loose parts in construction areas, multiple response analysis identified four main difficulties. First, 23.2% of teachers reported superficial exploration of materials by children. Second, 18.7% encountered difficulties in implementing their intended objectives and plans. Additionally, 18.7% struggled with sustaining children's interest, while 17.2% faced challenges in creating supportive environments for loose parts. To address these issues, teachers need guidance to stimulate children's interest and encourage deeper exploration,

while also focusing on plan execution and environment setup. To determine whether different age groups exhibit similar distribution patterns in difficulties encountered when providing loose parts in construction areas, researchers conducted homogeneity testing. The chi-square test results showed a significant P-value of 0.000*** across age groups, indicating a rejection of the null hypothesis and confirming significant differences in the difficulties encountered by different age groups. Therefore, age-specific considerations should be implemented to address these challenges through targeted interventions. Faced with challenges in organizing loose parts for construction play, kindergarten teachers seek professional guidance on material selection and implementation. The most desired support comes from theoretical frameworks and practical strategies to enhance children's hands-on exploration and creative development, with 25.9% of respondents prioritizing this aspect. Teachers also expressed interest in obtaining reference teaching cases, establishing clear guidelines, creating supportive play environments, and developing targeted educational objectives with effective implementation plans.

3.3. Strategies for the Placement and Support of Loose Parts in Construction Area

Based on the coding of loose parts application strategies in kindergarten construction zones, teachers consciously adjust their approaches according to existing motivations and plans. Teachers employ multiple strategies when modifying loose parts construction activities. First, they brainstorm ideas and collaborate with children to solve problems together. This allows children to fully explore materials, discuss their findings, and independently propose construction plans. Second, they prioritize children's perspectives by providing free exploration space, anticipating their abilities and preferences, observing gameplay dynamics, and promptly adding new materials based on evolving interests. Interview coding reveals specific strategies in material selection, distribution, and activity implementation. For material selection, teachers analyze material properties in advance to ensure safety and non-toxicity, replace damaged materials promptly, choose "highly safe and highly malleable" materials, consider "easy accessibility," and pay attention to "color coordination between different materials." For material distribution, teachers conduct "prior observation and preparation" based on children's experiences and interests, "design material quantities and activity zones in advance," ensure safety during activities, and stimulate children's initiative in creative exploration while maintaining their autonomy. In activity construction, teachers guide children to explore freely and discuss discovered issues collectively. After materials are deployed, they continuously document and adjust based on children's play progress. Teachers observe children's operations, brainstorm during discussions, and provide supplementary materials according to feedback to deepen exploration. The "problem-guided approach, peer observation, and experience sharing" strategy is widely adopted. Educators allocate ample time and space for children to independently discover and pose questions using loose parts. Teachers actively monitor exploration processes, conduct group discussions post-activity, pose questions, and invite peers to answer, enabling children to solve problems through subsequent operations. Through repeated discussions, children develop more creative ways to use loose parts, uncover their potential, and sustain interest and curiosity. As the main participants in material manipulation, children are constantly observed by teachers who provide exploration space and make timely adjustments based on their play activities. Teachers not only observe but also offer appropriate guidance, adjusting activity zones and material distribution according to children's needs. These strategies require thorough preparation: preliminary investigations and observations ensure environments meet preset objectives through timely material adjustments and feedback implementation.

When guiding young children in using loose parts in construction areas, teachers often adhere to educational principles that prioritize child-centered approaches while maintaining respect for material characteristics and instructional objectives. Analysis of teach-

ers 'guidance strategies reveals four key factors: 22.3%,22.3%,20.1%, and 16.2% respectively, based on children's interests, developmental patterns, actual usage behaviors, and individual characteristics. Kindergarten teachers employ diverse strategies for loose parts use, primarily drawing from practical experience, children's post-operation feedback, and early childhood education theories. The analysis shows "practical experience" (29%), "children's post-operation communication" (25.9%), and "early childhood education theories" (19.6%) as primary sources. To enhance professional development, teachers should not only accumulate experience but also gain theoretical insights from academic resources and peer discussions to better guide children's material use. Key teaching strategies include: adopting children's perspectives, designing materials based on their interests, emphasizing material operability, and seizing educational opportunities to naturally facilitate further development. After introducing loose parts into construction areas, teachers gain valuable experience. Analysis of their instructional strategies shows: 18.4% prioritized "materials selection based on children's interests", 17.9% focused on "material operability and safety", and 16.1% emphasized "educational opportunities with timely guidance". When implementing these materials, teachers employ specific approaches: selecting materials with practical value from daily life; demonstrating proactive engagement in material selection; following a structured implementation plan; executing guided activities according to preset objectives; closely monitoring children's progress; and adjusting materials and setup based on children's responses. Teachers also continuously evaluate the effectiveness of their strategies and the children's reactions throughout the process.

To investigate whether there are significant differences in construction area strategies employed by teachers with different levels of teaching experience, researchers conducted a one-way ANOVA, as this method allows for a comparison of means across independent groups. As the scale questions focused on specific strategy manifestations, total scores of strategy-related questions were used as the dependent variable. The ANOVA analysis revealed a significance level of 0.003 (less than 0.05), indicating distinct differences in the use of supportive strategies among teachers with varying teaching experience. The results demonstrated notable variations in several aspects, including the provision of recycled materials, proactive distribution, planning and implementing phased activities before material deployment, and guiding based on preset objectives. Additionally, teachers varied in how they monitored children's operations, adjusted materials according to responses, and achieved effective outcomes in material application. These findings suggest that teaching experience influences strategy selection, implementation, and effectiveness, highlighting the need to pay attention to the strategies adopted by teachers at different career stages.

4. Discussion

Implementing layered progressive material design enhances exploration complexity. Teachers should move beyond basic perceptions of loose parts, such as their simplicity and everyday applicability, and instead systematically develop hierarchical material sequences. Guided by Vygotsky's Zone of Proximal Development theory, instruction should follow the "skill progression" principle. For example, when introducing building blocks, educators can progress from laying flat surfaces to constructing roofs, ultimately developing complex structures that align with children's cognitive development [10]. At the same time, teachers should diversify designs by integrating recycled materials and natural resources. While ensuring an adequate quantity of materials, teachers should apply color psychology principles and use varied structural forms to stimulate sustained exploration. This approach resolves superficial operational challenges, facilitating children's transition from simple manipulation to deep learning [11].

Establish a dynamic adaptive adjustment mechanism to address diverse needs. To tackle challenges like waning interest and age differences among preschoolers, teachers should develop responsive adjustment loops. When observing exploratory stagnation,

immediately initiate the "observe-discuss-reconstruct" process by facilitating group discussions and adjusting material combinations or introducing new stimuli. Implement personalized differentiated management [12]. Small classes focus on sensory stimulation (dynamic materials/visually stimulating colors), while middle and large classes emphasize functional expansion (cooperative construction). Establish an individual experience bank to provide scaffolding for inexperienced learners and create peer imitation opportunities, such as a 'work display corner', transforming teachers' observations into targeted support strategies [13].

Rooting instructional plans in teachers' intrinsic motivation systems. To address the disconnect between preset objectives and task-driven implementation, it is essential to reframe the motivational factors that guide teachers' practices, ensuring alignment with children's developmental needs [7]. Guide teachers to design activities from developmental value perspectives: initially focusing on children's interests, then adopting collaborative planning by inviting them to co-create game rules, and finally establishing flexible evaluation metrics. The three-phase implementation should concentrate on transforming intrinsic motivation. During the preparation phase, teachers should identify implicit educational goals embedded in the use of loose parts, such as fostering creativity, problem-solving, and independent exploration. In the activity adjustment phase, emphasize reflective analysis of "children's behaviors and ability development" connections [14]. Ultimately, developmental motivation should serve as the core principle in the formulation of instructional plans, ensuring that activities are tailored to support children's growth.

Develop an operational structured activity framework to enable system support. Teachers can create core themes based on classroom culture or children's interests (e.g., 'Magnetic City'). Using loose parts such as scrap metal and magnetic tiles, teachers can track operation time and assess the complexity of the game scenarios to gauge children's engagement and developmental progress. When repeated building exceeds three times, teachers initiate new scenarios through role-playing, transforming material value from superficial manipulation to deep learning [15].

5. Conclusion

This study is valuable for empirical research on enriching loose parts in kindergarten construction areas. The study systematically explored the cognitive-motivational-behavioral support process of teachers' loose parts, which filled the gap of the existing studies that mostly stayed at the level of strategy descriptions, and lacked in-depth exploration of motivational chains and dynamic support mechanisms. Compared to previous studies, this study not only confirmed the dual advantages of loose parts in promoting children's development and enhancing teaching efficiency but also elaborated on teachers' multidimensional evaluation criteria (maneuverability, malleability, and variety). Additionally, it explored both internal and external motivational factors and revealed specific challenges, such as insufficient children's participation and the mismatch between curriculum objectives and spontaneous activities. These details have been less explored in depth in previous studies. This study breaks through the limitations of existing research by proposing targeted improvement strategies such as layered progressive material design and dynamic individualized adjustment. These strategies help to solve the problems of fragmentation and superficial support of material arrangement in practice, emphasize the rooting of instructional planning in teachers' intrinsic motivation, and construct an actionable framework, which is more practical than previous generalized strategy suggestions. However, the sample size was limited, the observation method was not used, which resulted in a single source of data, and the differences in the material needs of children of different ages were not analyzed in depth. In the future, we can expand the sample size and conduct a longitudinal tracking study to verify the long-term effects of the strategy and explore the applicability of the framework in different types of kindergartens, so as

to promote the systematic application of loose parts in the construction area and better support children's holistic development.

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