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A Study on Innovative Approaches to Using Sensory Integration Toys in Nursery Schools from a Play Perspective

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Abstract: Sensory integration training, as a vital educational method for promoting the coordinated physical and mental development of young children, has garnered significant attention in the field of early childhood education in recent years. Traditional sensory integration toys predominantly consist of standardized, functional equipment, whose usage is often confined to predetermined rules and fixed procedures, making it challenging to fully stimulate children's autonomy and creativity. This paper adopts a "play perspective" to explore innovative approaches to using sensory integration toys in kindergartens. It advocates integrating sensory integration training into free, open, and imaginative play activities to enhance the enjoyment, contextual relevance, and individual adaptability of sensory integration education. Through literature analysis, case studies, and educational observations, the paper proposes four innovative application models: "play-based reconstruction", "cross-domain integration", "role-driven engagement", and "environmental creation." These models are validated within practical teaching contexts. Findings indicate that employing sensory integration toys through a play-based approach not only effectively enhances children's sensory integration abilities but also fosters their social skills, creativity, and problem-solving capabilities. Finally, this paper offers optimization recommendations, providing kindergarten teachers with actionable teaching strategies to advance sensory integration education towards a more humanistic and child-centered approach.

Keywords: Game-based perspective; Sensory integration toys; Innovative application; Kindergarten; Sensory integration; Educational innovation

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1. Introduction

With the deepening of the "child-centered" educational philosophy, the holistic development of children has become the core objective of preschool education and practice, with particular emphasis placed on the development of sensory integration abilities. Sensory integration constitutes the critical process whereby the

brain synthesizes information from visual, auditory, olfactory, gustatory, tactile, vestibular, and proprioceptive systems to generate adaptive responses. Early childhood represents a crucial developmental window for this process; adequate sensory stimulation and motor experiences during this period may influence attention, emotional regulation, learning capacity, and even social adaptation. However, while kindergartens currently provide various sensory integration toys (such as balance beams, tactile boards, and stilts), their use often follows formulaic patterns that neglect children's active participation. This may stifle their initiative and creativity. Consequently, this study adopts a play-based perspective to explore novel approaches for employing sensory integration toys in kindergartens, aiming to guide innovative usage strategies that better serve children's holistic development [1–4].

2. Traditional usage patterns of sensory integration toys and their limitations

2.1. Characteristics of traditional usage patterns

Current sensory integration toy usage in kindergartens exhibits the following core characteristics: Firstly, a pronounced goal-oriented approach, where activity design centers on enhancing specific sensory integration abilities such as balance, tactile discrimination, and vestibular stimulation. Content is tightly aligned with predetermined objectives, reflecting a strong functional orientation. Secondly, clearly defined standardized procedures, with teachers typically establishing fixed activity sequences including warm-up preparation, main activities, and cool-down relaxation phases, emphasizing standardized movements and safety. Thirdly, strong teacher-led direction, with educators acting as organizers and guides during activities, while children predominantly participate passively, required to strictly follow instructions to complete tasks; Fourthly, fixed equipment functionality, where each sensory integration toy typically serves a specific purpose—such as stilts primarily for balance training or tactile boards for sensory stimulation—resulting in limited versatility and difficulty in adapting flexibly to individual children's needs; Fifthly, evaluation methods are singular, predominantly relying on accuracy, speed, or repetition of actions as metrics. There is insufficient attention to children's emotional experiences, cooperative behavior, and creative expression—key aspects of holistic development—failing to comprehensively reflect the actual efficacy of sensory integration training [5].

These characteristics reveal the limitations inherent in traditional sensory integration toy usage patterns, while also providing practical grounds for exploring subsequent gamified innovation pathways [6]. Breakthroughs are required in areas such as goal flexibility, process openness, role equality, functional diversity, and comprehensive evaluation to better realize the educational value of sensory integration toys.

2.2. Existing limitations

Whilst traditional sensory integration toys can enhance foundational sensory integration abilities to some extent, their limitations are increasingly apparent. On one hand, children exhibit insufficient initiative: under conventional approaches, they lack choice and decision-making authority during activities, passively complying with teacher directives. This results in markedly lower engagement and attention compared to self-directed exploration. Research indicates that passive participation diminishes intrinsic motivation, gradually eroding children's interest in sensory integration activities. On the other hand, the rigid format of play is problematic: many sensory integration toys focus solely on mechanical training. For instance, a skateboard is used exclusively for straight-line gliding practice, without integrating it into scenarios like "space travel" [7]. This restricts children's imagination and problem-solving abilities, making it difficult to inspire sustained engagement. Furthermore, there is a lack of social

interaction and cooperative experiences: traditional sensory integration activities predominantly involve individual completion or task-oriented approaches, lacking collaborative design. Children seldom have opportunities to complete tasks or share experiences with others. This model hinders the development of cooperative awareness and social skills, making it difficult for them to integrate into group play scenarios. Finally, integration with other domains is inadequate: traditional sensory integration toys typically function solely within the motor domain, failing to incorporate elements from language, art, science, and other areas (e.g., balance beams focus solely on equilibrium without integrating counting "steps taken across the beam" or directional terms like "two steps to the left"). This prevents children from transferring sensory integration experiences to complex real-life scenarios, hindering the formation of a comprehensive cognitive framework.

3. Theoretical foundations and implications of the play perspective

3.1. The educational value of play

Play is not only inherent to childhood but also a vital pathway for learning and development. Piaget posited that play constitutes the primary form of cognitive development in children, enabling them to internalize external experiences and construct knowledge systems through symbolic play [8]. Vygotsky emphasized play's role within the "zone of proximal development", arguing that it facilitates children's transcendence of their current developmental level to achieve higher-order psychological functioning [9]. Furthermore, play facilitates children's emotional regulation, social interaction, and moral development [10]. Contemporary educational theory regards play as an ideal vehicle for "deep learning." It permits children to experiment, fail, reflect, and re-attempt within a secure environment, thereby constructing complex knowledge and higher-order abilities. As advocated by Chen Heqin through "learning by doing, learning through play", play constitutes the core method by which children actively construct their experiences [11].

3.2. The essence of the play perspective

The spirit of play does not merely point towards "gamification" or rely solely on altering activity formats. Its core tenets lie in respecting children's autonomy and joyful experiences, organically embedding emotional training within natural, open, and meaningful play contexts. Its core essence can be analyzed from multiple dimensions: Firstly, the fundamental unit, which prioritizes children's interests, needs, and developmental levels. It emphasizes educators respecting children's agency within play, accommodating and supporting their ideas. Secondly, a process-oriented approach, valuing exploration, discovery, and firsthand experience over outcomes or skill acquisition. It permits aimless exploration and unconventional play styles. Thirdly, it involves scenario creation, where imaginative play settings (such as "Underwater Worlds" or "Space Capsules") are employed to assign new functions and meanings to toys, enhancing immersion. Fourthly, it balances freedom with rules, establishing necessary frameworks while ensuring ample space for free exploration. This approach safeguards safety and order while encouraging collaborative rule-making. Fifthly, openness and generativity require both content and form to possess open-ended qualities, permitting young children to flexibly adapt play based on personal interests and facilitating generative curriculum implementation. Under this philosophy, play ceases to be isolated "training material" and instead becomes an active, creative practice arena for children. Its role transforms from a singular medium into an interactive connecting bond, with usage becoming increasingly diverse, dynamic, and inventive [12].

4. Innovative applications of sensory integration toys through a play perspective

4.1. Gamified reconstruction: Reimagining toy functionality

"Gamified reconstruction" involves altering the original function and usage of sensory integration toys through narrative scenarios, role-playing, or challenge-based tasks, integrating them into more engaging play activities.

Case Study 1: "Jungle Exploration" with multi-functional stilts

Traditionally, stilts primarily serve balance training. Under "gamified reconstruction", educators may create a "Jungle Expedition" scenario: children embody "explorers," with stilts becoming "logs crossing swamps", sensory discs transforming into "mysterious stone circles", and scooters evolving into "speeding sledges." Children must maintain balance in "danger zones" while seeking "treasure." This approach not only enhances balance but also stimulates imagination, language expression, and problem-solving skills. Teachers may further guide children to draw "exploration maps", documenting routes and discoveries to achieve cross-curricular integration [13].

4.2. Cross-domain integration: Transcending subject and equipment boundaries

"Cross-domain integration" refers to combining sensory toys with other domains (such as language, art, science) or multiple pieces of equipment to achieve coordinated development across multiple senses and abilities.

Case Study 2: Integrated play with the "River Movement Set"

The "River Movement Set" includes equipment such as balance beams, soft mats, and rollers. Teachers may combine it with music and storytelling: Playing flowing water sounds while children role-play as "fish" navigating the "river", requiring them to traverse the balance beam ("stone bridge"), crawl through rollers ("caves"), and jump over mats ("waves"). Rhythm games are integrated, such as walking to the tempo of drumbeats. This activity combines vestibular, proprioceptive, auditory, and rhythmic senses while developing musical perception and physical expression. Teachers may guide discussions on "river formation" and "fish behavior" to link scientific knowledge.

4.3. Role-driven: Stimulating active participation through roles

"Role-driven" refers to assigning children specific roles (e.g., firefighter, doctor, astronaut) to inspire a sense of responsibility and mission, thereby encouraging active engagement in sensory integration play.

Case Study 3: "Little Firefighters" rescue operation

Simulate a "fire scene" using equipment like slides, climbing frames, and balance beams. Children assume the role of "firefighters", requiring them to swiftly traverse the "fire scene" (crawling mats), scale the "high-rise building" (climbing frame), and cross the "wobbly bridge" (balance beam) to execute "rescue operations." This activity not only develops gross motor skills and sensory integration abilities but also cultivates courage, responsibility, and teamwork. Teachers may guide discussions on "safe evacuation procedures" and "fire safety knowledge" to enhance safety awareness.

5. Environment creation: Child participation in game design

"Environment creation" refers to encouraging children to participate in planning sensory integration games and arranging equipment, enabling them to become the "designers" and "creators" of the games.

Case 4: Children independently construct an "Adventure Playground"

Teachers provide various sensory integration equipment (such as soft mats, arches, ball pits, ladders) and guide children to discuss and design their own "adventure playground" in groups. Children must negotiate layouts,

establish rules, and test safety. This process not only develops spatial cognition and planning skills but also enhances cooperation, communication, and critical thinking. Teachers may document children's design plans and discussion processes as course evaluation materials.

6. Educational value of innovative usage

From a play perspective, innovative applications of sensory integration toys offer multiple educational benefits. Firstly, they significantly enhance the enjoyment and sustainability of sensory training through contextualized, role-based designs that stimulate children's motivation to participate, enabling them to continuously develop sensory skills within pleasurable experiences. Research indicates participation rates in such activities exceed traditional training methods by over 30% [14]. Secondly, it facilitates the holistic development of children's comprehensive abilities—transcending the limitations of single-skill training, it enables children to simultaneously develop motor skills, language expression, social interaction, emotional regulation, and other competencies during play. For instance, in firefighter role-play, children can enhance both physical coordination and problem-solving abilities while developing social role recognition. Thirdly, it fully respects individual differences and autonomy—permitting children to select play methods based on personal interests, catering to the unique needs of different developmental stages. In the "Architect" game, for instance, children independently decide the theme and approach of their constructions, thereby unleashing creativity. Fourthly, it effectively enhances teacher-child interaction and peer collaboration. Sensory integration toys serve as "play companions", fostering positive connections between educators and children, as well as among children themselves, thereby cultivating relationships built on equality and mutual trust. For instance, in the "Traffic Engineer" game, teachers and pupils jointly explore play methods, deepening the collaborative atmosphere. Fifthly, it enables natural curriculum integration—incorporating sensory integration training into thematic activities or courses (e.g., the "Parachute Drop" game) makes sensory sessions an organic component of the curriculum rather than isolated activities, promoting systematic and life-oriented teaching content [15].

7. Implementation recommendations and challenge management

The implementation pathway for sensory integration toy adaptation must prioritize the deep integration of "gamification" with sensory training, driven by multi-dimensional measures: Firstly, transforming teacher guidance, shifting the teacher's role from director to observer and facilitator. Support children's autonomous exploration by providing challenging game scenarios (e.g., adding obstacles) rather than direct intervention; Secondly, optimizing environments and materials by creating rich, open, and modular sensory integration spaces equipped with multifunctional resources (e.g., balance beams adaptable for walking, role-play, and varied training). Dedicated play structures should permit children to freely combine materials for activities. Thirdly, implementing safety protocols by conducting regular hazard assessments of venues and equipment with safety as the baseline. Children should be permitted to learn through trial and error (e.g., attempting balance exercises of varying difficulty). Safety boundaries should be communicated to parents via meetings to secure understanding and cooperation. Fourthly, professional development frameworks should be established through tiered teacher training covering sensory integration theory, play design (including scenario creation and difficulty progression), and assessment methodologies. This enhances the team's capacity for gamified teaching, with reform effectiveness evaluated through observation logs and portfolio analysis. Fifthly, advancing home-school collaboration. Break the

limitations of solitary play by regularly organizing parent-child sensory integration game days, involving parents in children's learning processes to foster family recognition and support for gamified education. Only through multidimensional collaborative efforts can the deep integration of gamification and sensory integration training be achieved, enabling young children to naturally develop sensory integration abilities through joyful play [16–18].

8. Conclusion

Sensory integration toys should transcend mere "training tools" to become "magical instruments" that ignite children's spirit of play and creative potential. Approaching sensory integration toys from a play-based perspective and innovating their usage represents a vital pathway to prioritizing children's needs and realizing education's fundamental purpose. Through models such as gamified reconstruction, cross-domain integration, role-driven engagement, and environmental creation, sensory integration education can transcend the limitations of mechanical training, moving towards a future imbued with greater vitality, imagination, and humanistic care. It is hoped that more kindergartens and educators will boldly explore these approaches, enabling every child to achieve harmonious physical and mental development through joyful play. Future research may further investigate the long-term effects of gamified sensory integration education, its applicability across diverse cultural contexts, and innovative applications of digital sensory toys, thereby providing sustained momentum for high-quality development in early childhood education [19].

Disclosure statement

The author declares no conflict of interest.

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