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Practical Path Exploration of Low-Structure Materials Supporting Spatial Orientation Cognition in Young Children (Junior Classes)

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Abstract: Spatial orientation perception is an important part of mathematical cognitive enlightenment and physical and mental development in preschool children. Based on the age characteristics of junior-class children and one-year teaching practice, this study deeply explores the effective role of unstructured (low-structure) materials in cultivating children's sense of spatial orientation. The study points out that low-structure materials, with their open-ended, operable and life-based characteristics, can effectively stimulate children to independently explore, understand and apply spatial orientation concepts in specific situations. From three dimensions: material delivery strategies, teaching activity organization and teacher guidance methods, this paper systematically expounds the practical paths of how low-structure materials promote the development of spatial orientation cognition in junior-class children, and summarizes universally meaningful and replicable implementation suggestions, aiming to provide references for relevant education and teaching activities in kindergartens.

Keywords: Low-structure materials; Junior-class children; Spatial orientation cognition; Practical path

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1. Introduction

Spatial orientation perception, namely the individual's ability to understand and apply relative positional relationships such as up and down, front and back, left and right, is a key component of preschool children's mathematical literacy. According to the "Guidelines for Learning and Development of Children Aged 3–6", junior-class children need to initially perceive and understand the meanings of basic orientation words such as up, down, front, back, inside and outside. However, traditional teaching modes mostly rely on teacher explanations and picture displays, and children lack opportunities for hands-on operation and personal experience, making it difficult to internalize abstract spatial concepts [1].

Low-structure materials, such as stones, building blocks, bottle caps, cartons, etc., provide a broad exploration space for children due to their wide sources, diverse usages and unfixed purposes. How to

scientifically use these materials to transform abstract spatial concepts into perceptible and operable experiences for children? Based on practical exploration, this paper systematically summarizes scientific methods of using low-structure materials to cultivate junior-class children's sense of spatial orientation, and puts forward specific suggestions on material delivery, activity design and teacher support strategies.

2. Theoretical basis for low-structure materials promoting spatial orientation perception

2.1. Developmental characteristics of spatial orientation cognition in junior-class children

Children aged 3–4 are egocentric in spatial cognition and find it difficult to understand objectively fixed spatial relationships. Their learning has an obvious sequence: they first master vertical directions (up/down), then understand horizontal relationships (front/back), and finally distinguish left and right. Children at this stage must understand spatial concepts with the help of specific objects and personal operations, and abstract orientation words are meaningful only in specific situations [2]. Therefore, providing a variety of real objects for children to perceive spatial relationships through manipulation and combination is the most effective way to cultivate their sense of orientation.

2.2. Educational value of low-structure materials

The characteristics of low-structure materials make them ideal carriers for cultivating spatial perception in junior-class children.

(1) Open-ended: no fixed usage, children can combine freely with imagination and explore spatial relationships through continuous trial and error [3].

(2) Operable: materials are moderate in size and easy to grasp; children naturally perceive changes in spatial positions of objects through moving, splicing, arranging and other actions.

(3) Life-based: materials derived from daily life can quickly arouse children's interest and familiarity, enabling them to learn spontaneously in stress-free games [4].

3. Practical paths for cultivating spatial orientation based on low-structure materials

3.1. Material delivery strategy: From single to diverse, dynamic adjustment

Materials are the cornerstone of children's exploration, and delivery strategies directly affect learning effects.

(1) Basic materials: Select a small amount and present orderly

In the early stage of practice, select simulation animals, insect models, etc., as core materials. Such materials have no fixed usage and are especially suitable for games such as "hide-and-seek", which can intuitively construct spatial relationships such as "up and down" and "inside and outside". Considering that junior-class children are easily distracted, materials should not be too many. Adopt the form of "small quantity + large tray", placing 10–15 items per tray in classified order, which not only meets operational needs but also avoids interference [5].

(2) Auxiliary materials: Gradually enrich and expand exploration

When children are familiar with basic materials, auxiliary materials such as bottle caps, building blocks, leaves and stones can be gradually introduced. For example, when playing with hula hoops, adding bottle caps and plush toys, children will spontaneously create game scenes including various orientation

relationships such as “put the bottle cap inside the hoop” and “put the rabbit on the stool” [6].

(3) Graphic materials: Hierarchical design to support differences

To support children’s stepped development, design task graphics of different difficulties. Gradually transition from single instructions (e.g., “put the stone on the house”) to multi-directional combinations (e.g., “put the round stone on the left of the big stone”). This hierarchical design ensures that children at different developmental levels can obtain challenges and support within their “zone of proximal development”.

3.2. Activity organization strategy: Taking games as media, integrating situations

Skillfully integrating orientation learning into games is the core of teaching design.

(1) Construction games: Perceive space in operation

Building block construction is a natural field for spatial exploration. Children constantly think about position, balance and structural relationships in stacking and arranging. Teachers can intervene timely and guide children to pay attention to spatial details with inspiring questions, such as: “Where is the entrance of your castle? Is the roof on the top or the side?”

(2) Arranging games: Consolidate cognition in repetition

Such as the “stone arranging” game, where children need to place items in accurate positions according to graphics or instructions. From imitating graphics, to placing according to instructions (e.g., “put the beads in the shell”), to designing drawings for peers, progressive game forms allow children to skillfully use orientation words in repeated practice.

(3) Situational games: Transfer experience in experience

Integrate orientation learning into stories, such as “building houses for small animals”. Children need to think about “where is the most suitable place for the bed?” and naturally apply spatial orientation knowledge when solving problems in real situations. Integrate orientation learning with life links, such as saying “up” and “down” when going up and down stairs, and distinguishing “inside” and “outside” when tidying up toys, which can make abstract orientation words concrete and perceptible.

(4) Group games: Strengthen perception in interaction

Design group games for all children using low-structure materials, allowing children to strengthen their sense of orientation in physical exercise and peer cooperation. For example, the “Little Fish’s Home” game uses hula hoops and bottle caps to set up different areas. Children need to complete tasks such as “little fish swim out of the shell” and “put pearls back into the shell” according to instructions, and understand internal and external spaces in moving and placing. Such activities are not only fun, but also help timid children integrate into the group and learn together [7].

3.3. Teacher guidance strategy: Observation, response and scaffolding

Teachers’ roles are keen observers, wise responders and flexible scaffolders.

(1) Careful observation to understand children: the focus of observation includes: Can children understand and execute instructions with orientation words? Can they place items in the correct positions during operation? Can they describe their behaviors with orientation words? Only through observation can teachers accurately grasp each child’s developmental level.

(2) Timely response to expand thinking:

(a) Descriptive response: Describe children’s behaviors with accurate orientation words and provide

language models. For example: “You put the round stone on top of the building block.”

(b) Questioning response: Guide children to think further with open-ended questions. “What if you put this stone under another one?”

(c) Challenging task: Appropriately increase difficulty based on children’s success to promote their thinking development.

(3) Build scaffolding and withdraw in a timely:

(a) Material scaffolding: Adjust materials according to children’s activities. For example, provide a stable bottom plate when children’s structures are unstable.

(b) Peer scaffolding: Encourage capable children to share experience; peer demonstrations are often more effective than teachers’ preaching.

(c) Language scaffolding: Connect children’s actions with orientation words in language during operation, such as: “You moved the stone to the left.” After the operation, encourage children to retell the process.

4. Practical effects and reflections

4.1. Practical effects

After practical exploration, remarkable effects have been achieved:

(1) Children’s development: most children’s spatial orientation recognition ability has been significantly improved, and they can accurately understand and use orientation words such as up, down, inside, outside, front and back; in construction and arranging games, they can place items correctly as required; some children can try to describe their works and operation processes with orientation words [8].

(2) Teachers’ growth: participating teachers have systematically mastered the selection and application strategies of low-structure materials, improved professional abilities such as observation, interaction and scaffolding, and gained a deeper understanding of game-based teaching.

4.2. Reflections and suggestions

(1) Low structure does not mean no structure

Although materials are open, teachers’ delivery should have implicit educational purposes. This purpose should be skillfully integrated into materials and activity design, allowing children to achieve teaching goals in free exploration [9], realizing the transformation from “form to connotation”.

(2) Pay attention to the continuous interaction between materials and children

Material delivery is a process of dynamic adjustment. Teachers need to continuously observe the interaction between children and materials, and flexibly adjust the type, quantity and placement of materials according to changes in children’s interests and abilities [11,12], so as to maximize the value of materials in continuous interaction.

(3) Value process rather than result

In games with low-structure materials, children’s exploration process is more important than work. The experience of repeated trial and error and continuous adjustment is in-depth learning itself [13]. Teachers’ focus should shift from “right or wrong” to “how children play and think”.

(4) Tap the potential of peer mutual assistance

The mutual influence between children is often greater than teachers’ direct teaching. Teachers should actively create a mutual assistance atmosphere, encourage capable children to become

"little mentors" [14], and let peer learning occur naturally in a relaxed atmosphere through sharing and demonstration, promoting the common progress of all children [15].

5. Conclusion

Low-structure materials, with their convenient and life-based characteristics, provide a broad platform for the development of spatial cognition in junior-class children. Only through scientific material delivery, ingenious activity design and timely teacher guidance can their educational value be truly exerted , effectively promoting the development of children's spatial perception ability.

The real value of low-structure materials lies in providing children with opportunities to "make mistakes" and "trial and error" . In the process of constantly playing with building blocks and moving stones, children are constructing their understanding of the surrounding world with their own hands. When abstract spatial concepts become touchable and playable in the real world through hands-on operation, educational goals have been achieved. This is the most precious gift that low-structure materials bring to spatial education for junior classes.

Disclosure statement

The author declares no conflict of interest.

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