

Development and Implementation of a Kindergarten-Based Curriculum for the “Three-Dimensional” Motor Skill Development of Young Children

Yan Zhang^{1*}, Shaosheng Yu^{2#}

¹Shilong Central Kindergarten, Dongguan, China

²Early Childhood Education Department, Shilong Education Management Center, Dongguan, China

Email: ^{*}743893515@qq.com

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Abstract

This study focuses on the development of young children’s “three-dimensional” motor skills and elaborates on the process, outcomes, and significance of the kindergarten-based curriculum development and implementation. Through methods such as literature review and experimental research, a kindergarten-based curriculum centered on “three-dimensional” motor skill development was constructed. The curriculum was tested through teaching practice and effectively promoted children’s motor development, providing valuable references for the development of early childhood physical education curricula.

Keywords

Three-Dimensional Motor Skills, Kindergarten-Based Curriculum, Physical Games

1. Introduction

In the field of early childhood education, the development of motor skills is an essential component of children’s early growth. Motor skills are not only closely related to children’s physical health but also play a key role in the formation of cognitive, emotional, and social interaction abilities. In recent years, with the introduction of national policies such as the “Healthy China 2030” Plan and the

*The first author.

#Corresponding author.

“Outline for the Construction of a Sports Powerhouse”, the importance of early childhood physical education in national strategy has been highlighted, reinforcing its significant value and promoting the concept of comprehensive early childhood development (CPGPRC, 2016). Increasing attention has been paid to the multidimensional development of young children’s motor education. However, most current kindergarten curricula still have certain limitations in motor skill training, often focusing on single-dimensional motor skill training and neglecting the comprehensiveness and systematicness of motor skills. Therefore, this study aims to develop a kindergarten-based curriculum centered on young children’s “three-dimensional” motor skills to enhance their physical fitness and motor abilities, which is of great theoretical and practical significance for promoting the comprehensive and healthy development of young children.

2. Conceptual Definitions and Literature Review

2.1. Key Concept Definitions

2.1.1. Motor Skills

In this study, motor skills refer to the ability to proficiently perform various motor tasks and physical activities. This includes not only health-related physical qualities such as strength, endurance, speed, agility, and flexibility but also reflects the comprehensive ability to complete motor tasks. Motor skills are not merely a simple aggregation and integration of physical qualities but rather a complex outcome of the intercombination, interconnection, interplay, and mutual constraints among various elements.

2.1.2. “Three-Dimensional” Motor Skills

The development of motor skills in early childhood specifically refers to “three-dimensional” motor skills, which encompasses the development of balance, agility and coordination, and strength and stamina. “Three-dimensional” motor skills are derived from a developmental perspective of young children, summarizing the key basic motor skills that play a crucial role in their growth process. These skills are essential for the healthy physical, psychological, and social development of young children.

2.2. Research Review

2.2.1. Relationship between Growth and Development and Motor Skills

Children in the basic education stage exhibit significant differences in the development of their bodily tissues, organs, and physiological systems. These differences result in marked variations in anthropometric indices (such as height and weight) and motor skills and functions among children of similar ages. Consequently, some scholars have conducted extensive research on the relationship between growth and development status, genetic factors, and motor performance. In the early 1950s, Seils (1951) demonstrated through research a significant positive correlation between skeletal maturity and motor performance in children aged 6 - 9. Subsequently, other researchers have also reported significant correla-

tions between growth maturity and motor performance. [Lefevre et al. \(1990\)](#) conducted a renowned longitudinal study, administering physical fitness tests to 173 Belgian boys both during their pubertal growth spurt and in adulthood, and comparing their motor performance before and after. The results indicated that during adolescence, there was a negative correlation between the age at the growth spurt and limb movement speed, explosive power, and static strength performance. That is, children who developed early had significantly better motor performance than their late-developing peers. However, as they grew older, especially in late adolescence and adulthood, the motor performance of late-developing children not only caught up with that of their early-developing counterparts but also surpassed them significantly in explosive power and functional strength performance. [Katzmarzyk et al. \(1997\)](#) examined the interrelationships between bone age development, body shape, strength, and motor skills in children with calendar ages of 7 - 12 years. The study found that bone age, rather than calendar age, could significantly predict motor skills, and that calendar age and bone age development do not progress at the same rate. As children's bodies continue to grow and develop, the impact of early motor skill proficiency on motor performance is also evident. Since the completion of motor tasks requires a high level of motor coordination, proficiency in motor skills can limit motor performance. [King-Dowling et al. \(2016\)](#) proved through a long-term study that the proficiency of early basic motor skills in boys and girls can highly predict muscle explosive power performance. [Barnett et al. \(2008\)](#) found that children's early object control skills can significantly promote subsequent endurance performance. However, there are marked gender and age differences in the development of children's motor skills, especially in early basic motor skills. Although scholars worldwide have yet to reach a consensus on gender and age differences in various motor skill performances, some studies have identified notable disparities. For instance, [Kokštejn et al. \(2017\)](#) found that Czech preschool girls lag behind boys in catching and throwing skills, and [Hardy et al. \(2010\)](#) reported significant gender differences in locomotor and object control skills among Australian children. However, other researchers, including those in our country, have found no such differences in locomotor skills between boys and girls. The inconsistencies in these findings may be attributed to two factors: first, children's body shapes may influence their motor skill performance; second, the varying measurement methods used by researchers in assessing motor skills could lead to different results.

2.2.2. Relationship between Physical Fitness and Motor Skills

Existing research indicates that motor skills are determined not only by genetic factors but also by non-genetic factors reflecting physical fitness, such as body mass index (BMI) and physical activity levels. Many studies have established a correlation between BMI and children's endurance performance ([Hussey et al., 2007](#); [Phills & Parker, 1991](#)). However, the impact of BMI on children's static and dynamic balance remains controversial. While some studies have found that overweight school-age children exhibit poorer static and dynamic balance compared

to their normal-weight peers, [Niederer et al.'s \(2012\)](#) research showed that although overweight children have inferior dynamic balance, their static balance is better. Further analysis of motor skills by some researchers revealed that, generally, there is no significant difference between walking and running skills and BMI ([Vameghi et al., 2013](#)). However, when it comes to more complex movements or tasks with higher motor demands, such as jumping with both feet, hopping on one leg, or skipping, obese or overweight children face difficulties ([D'Hondt et al., 2009](#)). This may be because BMI only significantly affects certain motor skills, not overall motor performance or simple motor skills. Additionally, in early childhood, when motor skill proficiency is generally low, the impact of BMI is not pronounced. As children grow older, obese or overweight children may increasingly show deficiencies in more motor skill dimensions. For example, British scholars have demonstrated that in the later stages of childhood, running skills, which were previously unrelated to BMI, become significantly impaired as BMI increases after the age of 6 ([Bryant et al., 2014](#)).

Motor skills also significantly influence physical activity participation, thereby affecting cardiopulmonary function and other health-related aspects. Based on the assumption that children with good body control are more active, studies have shown a close link between physical activity and motor skills ([Wrotniak et al., 2006](#)). [Barnett et al. \(2008\)](#) found that moderate-to-vigorous physical activity levels in early childhood significantly affect locomotor skill performance, and in later childhood, physical activity at this intensity can influence both locomotor and object control skills. This proved that early childhood physical activity levels positively impact fundamental motor skill development. This conclusion is understandable, as motor skills are a basic requirement for participating in various physical activities, and physical activity at a certain intensity can promote the development of motor skills.

2.2.3. Relationship between Early Childhood Physical Activities and Motor Skills

The development of young children's motor skills is closely related to the physical activities conducted in kindergartens. In this regard, the "Kindergarten Physical Activity Syllabus" and "Reflections on the Content System of Early Childhood Physical Activities," both edited by Professor [Zhuang Bi \(2016\)](#), emphasize the basic principles that kindergartens should follow when conducting physical activities, the content settings of early childhood physical education curricula, and teaching methods and accompanying equipment. They have also developed equipment for the development of "three-dimensional" motor skills, aiming to enhance young children's "three-dimensional" motor skills through physical education courses (activities). Research papers such as "The Significant Role of Motor Skills in Promoting Physical Activity and Health in Children and Adolescents—A Review Analysis Based on the Motor Skill Research Model" present models based on motor skill research, highlighting the profound significance of motor skills in the 3- to 6-year-old age group for promoting physical activity and physical fitness in children and adolescents. They have also developed some physical activity equip-

ment. Based on this, early childhood physical activities, as carriers of early childhood physical education curricula, are an important means of developing young children's motor skills.

2.3. Research Review

In summary, children's ability development is closely related to growth and development, physical fitness, and early childhood physical activities. However, most studies have focused on school-age children rather than young children. Moreover, discussions on the development of young children's "three-dimensional" motor skills have been limited to theoretical exposition or speculation, lacking practical verification to test the effectiveness of kindergarten-based curricula for "three-dimensional" motor skill development. Surveys have revealed that the current status of motor skill development among young children in Dongguan is not ideal, with many failing to meet standards. Outdoor activities often become mere formalities, primarily due to the following reasons: First, the educational philosophy equates regular physical activities with motor skill development; second, teachers lack relevant professional knowledge and teaching skills training; third, there is a lack of systematic textbooks, equipment, and teaching resources; and fourth, there is an absence of scientific and comprehensive evaluation standards and methods for motor skill development. Therefore, this study, based on the development of young children's "three-dimensional" motor skills, integrates this development organically into early childhood physical games and constructs a kindergarten-based curriculum (scheme) for physical games based on "three-dimensional" motor skill development to test its effectiveness and lay the foundation for creating a unique brand for each kindergarten.

3. Research Objects and Methods

3.1. Research Objects

A total of 400 children from large, medium, and small classes of Shilong Central Kindergarten in Dongguan were selected, including 211 boys and 189 girls, ensuring the representativeness of the research subjects.

3.2. Research Methods

3.2.1. Literature Review Method

Utilizing the search engines of CNKI, Weipu, and Wanfang Data, we collected literature published in the last decade related to "motor skills", "three-dimensional motor skills", and "kindergarten-based curriculum". We sought to explore the feasibility and operability of developing a kindergarten-based curriculum for the development of young children's "three-dimensional" motor skills, thereby providing a theoretical underpinning for this study.

3.2.2. Experimental Method

Initially, we assigned class numbers to the large, medium, and small classes and randomly selected half of the classes as the experimental group, with the remain-

ing classes serving as the control group. We conducted a pre-test on the experimental classes to understand their baseline conditions. Subsequently, relying on the expertise of early childhood physical education specialists and the “three-dimensional motor skills” assessment criteria developed by Professor Zhuang Bi in the “Kindergarten Physical Activity Syllabus”, including measurement indicators for balance, agility and coordination, and strength and stamina across different age groups, we carried out pre- and post-tests and comprehensive evaluations to assess the effectiveness of the kindergarten-based curriculum centered on “three-dimensional” motor skill development. This provided a basis for future kindergarten-based curriculum teaching. Finally, we conducted a quantitative comparative analysis of the data obtained from the pre- and post-tests to determine the effectiveness of the kindergarten-based curriculum and to substantiate its impact on children’s motor development.

1) Purpose of the Experiment

To explore the implementation effects of physical games based on “three-dimensional” motor skill development.

To construct a kindergarten-based curriculum for rural sports games with Lingnan characteristics, based on the development patterns of “three-dimensional” motor skills.

2) Experimental Hypotheses

The implementation of physical games based on “three-dimensional” motor skill development will have a positive effect on children’s motor development.

A kindergarten-based curriculum for rural sports games with Lingnan characteristics can be effectively constructed based on the development patterns of “three-dimensional” motor skills.

3) Experimental Time and Location

September 2022 to December 2022, at the leading kindergarten where the project was based.

4) Experimental Arrangement

The experimental and control groups were assigned different curricula. The experimental group was taught using the kindergarten-based curriculum centered on “three-dimensional” motor skill development, while the control group followed the traditional physical education curriculum. We conducted mathematical statistical analysis on the teaching outcomes of both groups to examine the effectiveness of the physical games based on “three-dimensional” motor skill development.

5) Experimental Curriculum Design

The curriculum comprises the following four types:

a) Basic courses

The basic course mainly focuses on collectivized sports games, including basic action games, regional sports games and folk sports games.

i) Basic movement games are the most common type of game activities in kindergartens. They mainly involve basic movements such as walking, running, jumping, throwing, climbing, crawling, and climbing. During the game activities,

teachers can create activities with contextual elements, allowing children to engage in role-playing games and then complete corresponding tasks.

ii) Area-based sports games are designed based on the daily physical activities and skill requirements of children of different age groups. Through reasonable area arrangements, they provide sufficient effective materials and equipment to establish outdoor sports game areas in kindergartens. Various interesting signs and vocal guidance are used to guide children to learn and exercise in a cheerful atmosphere. For example, there are vehicle areas, field battle areas, construction areas, etc. Different interests and abilities of children can freely choose game items, catering to their preferences, and freely express themselves, becoming the true masters of the activities.

iii) Folk sports games are based on folk sports games that have been passed down, and they are sorted out, adapted, and innovatively applied. They explore the educational value contained in folk sports games.

b) Specialized courses

Specialized courses: Shilong Town is renowned as the “home of weightlifting”. World champion Chen Jinkai was born in Shilong Town, Dongguan. The construction of the only national-level specialized museum for weightlifting projects in China was officially activated in Shilong Town on March 2, 2021. To commemorate Chen Jinkai, inherit weightlifting culture, and promote weightlifting spirit, based on the development laws of children’s movements and their learning characteristics, we have created a series of weightlifting (weighted) game courses.

6) Testing Tools

Based on the “three-dimensional motor skills” assessment criteria developed by Professor Zhuang Bi in the “Kindergarten Physical Activity Syllabus,” including measurement indicators for balance, agility and coordination, and strength and stamina across different age groups, we conducted pre- and post-tests and comprehensive evaluations to assess the teaching effectiveness of the kindergarten-based curriculum for “three-dimensional” motor skill development (See **Table 1**).

7) Grouping Arrangement

Table 1. Grouping for the teaching experiment.

Age	Group	Count/N	Boy/(N1)	Girl/(N2)
3 - 4	Experimental Group	64	34	30
	Control Group	64	34	30
4 - 5	Experimental Group	74	38	36
	Control Group	74	37	37
5 - 6	Experimental Group	64	35	29
	Control Group	60	33	27

3.2.3. Observation Method

We created teaching scenarios related to motor skill development and carefully

observed children's behavioral performance in activities designed to develop "three-dimensional" motor skills. This allowed us to identify typical behavioral characteristics of motor skill development across different age groups.

3.2.4. Interview Method

Based on the theory of "three-dimensional" motor skill development, we interviewed teachers about their views on this development and their understanding of it as a "kindergarten-based curriculum." We also explored how teachers translated this understanding into practice in kindergartens. Through in-depth interviews with teachers involved in the project, we gained insights into the issues they encountered, their reflections, and the basic situation of children's "three-dimensional" motor skill development during the construction of the "kindergarten-based curriculum." This information helped us improve the content and methods of teaching physical games based on "three-dimensional" motor skill development.

3.2.5. Mathematical Statistics Method

We collected experimental data, entered it into Excel and SPSS 25.0 statistical software, and conducted analyses and tests to obtain relevant statistical information, thereby providing data support for the study.

4. Research Results and Analysis

4.1. Implementation Effects of Physical Games Based on "Three-Dimensional" Motor Skill Development

Using the "Three-Dimensional Motor Skill Development Indicator Test and Evaluation Standard for Young Children," we conducted pre- and post-tests on the subjects to collect data. We also invited a professional team to provide operational guidance and scientific evaluation of the testing standards to ensure their standardization and scientific nature. After a six-month teaching experiment with physical games based on "three-dimensional" motor skill development, the experimental group showed a significant improvement in "three-dimensional" motor skills compared to the control group, indicating that these games have a positive impact on children's motor development and physical fitness. Specifically, at the beginning and end of the experiment, the development of "three-dimensional" motor skills among children of different age groups was not balanced. For the small-class children, significant progress was observed in single-leg standing, obstacle running, crawling on hands and knees, standing long jump, stepping up and down, prone support with both hands, and (right-hand) sandbag throwing.

However, progress was less noticeable in forefoot walking, walking between parallel lines, single-leg hopping in place, shuttle running, repeated crawling through hoops, and (left-hand) sandbag throwing. For the medium-class children, significant progress was observed in forefoot walking, single-leg standing with eyes closed, balance beam walking, obstacle running, shuttle running, repeated crawling through hoops, crawling on hands and knees, and stepping up and down. However, progress was less noticeable in single-leg hopping in place with eyes

closed, quadrant hopping, standing long jump, prone support with both hands, prone leg lifting, and (left- and right-hand) sandbag throwing. For the large-class children, significant progress was observed in obstacle running, standing long jump, hanging, prone leg lifting, and (left- and right-hand) sandbag throwing. However, progress was less noticeable in single-leg standing with eyes closed, balance beam walking, backward walking, single-leg hopping left and right, shuttle running, repeated crawling through hoops, and quadrant hopping. Overall, physical games based on “three-dimensional” motor skill development had the most significant impact on small-class children in obstacle running, standing long jump, prone support with both hands, and (right-hand) sandbag throwing; on medium-class children in forefoot walking, balance beam walking, obstacle running, and repeated crawling through hoops; and on large-class children in obstacle running, hanging, prone leg lifting, and (left- and right-hand) sandbag throwing. Therefore, the implementation of physical games based on “three-dimensional” motor skill development was effective in promoting the motor development and physical fitness of children across different age groups.

4.2. Construction of a Kindergarten-Based Curriculum for Physical Games Based on “Three-Dimensional” Motor Skill Development

Based on the perspective of “three-dimensional” motor skill development and in accordance with the “Kindergarten Education Guidance Outline (Trial)” and the “Guidelines for Learning and Development of Children Aged 3 - 6”, we developed a kindergarten-based curriculum for rural sports games with Lingnan characteristics. This curriculum is grounded in the developmental patterns of motor skills in young children and is designed to promote their enjoyment of movement, rich experiences, and willingness to take challenges. It includes a basic curriculum centered on folk sports games, regional sports games, and fundamental motor games, as well as a Lingnan-characteristic rural sports game curriculum centered on weight-bearing games. This curriculum aims to foster children’s enjoyment of movement, rich experiences, and willingness to take challenges, thereby promoting the coordinated and healthy development of their physical, cognitive, and personal skills. It also aims to help children develop solid motor skills, healthy physical and mental well-being, and strong sportsmanship, and to form an in-depth home-kindergarten co-education model. This provides a new path for the development of kindergarten-based curricula for rural sports games with Lingnan characteristics and Shilong as a model in the new era of early childhood education.

5. Research Conclusions and Educational Recommendations

5.1. Research Conclusions

The physical games based on “three-dimensional” motor skill development effectively promoted the development of children’s “three-dimensional” motor skills. The kindergarten-based curriculum scheme was successfully constructed, and the

compiled textbooks and lesson plans were recognized by all parties.

Furthermore, the quality class evaluation activities based on the “three-dimensional movement” ability are regularly carried out, and the teachers are scored from five aspects: activity target design, activity content design, activity process control, teacher quality and early childhood development. After that, the teachers’ education and teaching ability are improved by participating in many discussions. At the same time, the kindergarten teaching and research work is based on the kindergarten. To realize the co-construction research, the research contents of different kindergartens need to be connected with each other. Under the background of the current gamification of curriculum, “Be willing to exercise, have experience and dare to challenge” is determined as the overall research theme, and how to let children get action development in rich and diverse sports game experience, cultivate sports interest and dare to challenge spirit is proposed. All participating parks focus on this theme, and then determine the research content based on the actual situation of the park. The shared research theme makes the basic direction and basic idea of the research in each school similar, and lays a foundation for the co-construction research of the faculty research community in the next step.

5.2. Educational Recommendations

Strengthen practical research on the “three-dimensional” motor skill development of young children, deepen its integration with early childhood physical education, and continuously enrich the curriculum content system. Build an innovative platform for home-kindergarten-community co-education and continuously deepen the characteristics of the kindergarten-based curriculum to assist in the “one-kindergarten-one-brand” construction.

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Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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