

Research on the Characteristics of Anterior Slide of 3~6-Year-Old Children From the Perspective of Movement Development

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ABSTRACT

In this paper, literature review method, video analysis method, logic analysis method and experimental method are used to study the movement characteristics of the anterior slide of 104 children aged 3 to 6 years in Jinan City, Shandong Province. As a result, the movement characteristics of entire slide and that of each limb segment of 3~6-year-old children are concluded as follows: first, the movement characteristics of entire slide of 3~6-year-old children can be divided into two stages such as intermittent running (in 3~4 years old) and being available to clearly distinguish front and rear legs (in 4~6 years old); second, the movement characteristics of each limb segment of 3~6-year-old children can be divided into leg movement development sequence and arm movement development sequence, wherein the former sequence is developed from being able to get rear leg moved beyond front leg (in 3~4 years old) to being able to get rear leg placed beside front leg (in 4~6 years old) and the latter sequence is developed from being able to keep two sides unmoved (in 3~5 years old) to being able to move arm up and down (in 5~6 years old); third, children's anterior slide movement may become more and more proficient with age increase, but it is not developed at a constant rate according to age.

Keywords: movement development, children, anterior slide, characteristics

I. INTRODUCTION

Movement is applied throughout the life of a person and is one of the most important basic abilities of human beings. The development of movement is a process that everyone has to experience, and it is an evolution of movement behavior in the whole life of people. People gradually learn to crawl, walk, write, throw, run and do all other forms of action of human beings. Sometimes their development of movement is rapid and obvious, such as the crawling of babies; sometimes the change extent is very small so that the state seems to be stable for many years. For example, the writing level of adults seems unchanged, although there are subtle changes every day [1]. It is important to understand the changes in people's movements in their lives as human beings' actions affect people's cognition, emotion, intellectual ability and social relationship. Therefore, it is very important to make research on movement of human beings. Since childhood is the beginning of formal education and the foundation of the whole life, basic movement skills will be learned during this period. Hence, childhood is the most important period for the development of a man's basic movement skills. Slide is also common in some sports such as

defend in sport of basketball, defensive pace in sport of baseball or softball, and the preparations before blocking in sport of volleyball [2]. In American elementary school, physical education teachers often use anterior slide to develop students' strength and coordination in legs, and use various forms of sliding exercises to test their cardiopulmonary function [3]. This shows that as one of the basic movement skills of human beings, anterior slide is of great significance to children's learning and life. So, it is needed to develop children's anterior slide movement skills.

II. RESEARCH OBJECT AND METHOD

A. Research object

This research took 3~6-year-old children from Weierlu Kindergarten in Jinan City and the first experimental kindergarten in Lixia District of Jinan City as the research object. Each age of children was considered as an age group and 40 children were sampled from each age group randomly. Totally, 120 children were taken as samples. Among them, 16 children provided invalid data for various reasons. Finally, 104 children (54 boys and 50 girls) provided valid data, as shown in "Table I".

TABLE I. DISTRIBUTION OF AGES OF THE TESTED OBJECTS

Age	Boy	Girl	Total
3-4	14	11	25
4-5	16	14	30
5-6	24	25	49
Total	54	50	104

B. Research method

1) *Literature review method:* By searching keywords such as "anterior slide" and "children" on CNKI, Taiwan Doctor and Master's Thesis Information Network, Wanfang Data, etc., more than 40 papers and works on movement development were collected, more than ten relevant literatures and more than 20 relevant research papers were inquired in the library in order to provide a solid theoretical basis for the writing of this paper.

2) *Video analysis method:* In this research, SONY HDR-PJ50E camera was used by professional video recorders to record the whole process of the test from the front and side of the tested children. After the test, the videos were collated, repeatedly observed to carefully analyze the movement characteristics of children.

3) *Logic analysis method:* The collected literatures, video and related data were analyzed, induced and summarized in methods such as concepts, reasoning and judgment.

4) *Experimental method:* The development characteristics of 3~6-year-old children in aspect of anterior slide were induced through the designed experiment and the corresponding results obtained from the experiment process.

III. DEVELOPMENT CHARACTERISTICS OF ENTIRE MOVEMENTS OF ANTERIOR SLIDE FOR 3~6-YEAR-OLD CHILDREN

By repeatedly observing the video and making research on the continuous anterior slide movements in overall sequence method, it is concluded that for 3~6-year-old children in developing this skill, it is most common to have two stages, namely stage I and stage II, as shown in "Table II". Anterior slide is a gradual transition from strange and discontinuous movements (such as exaggerated swing of the body in vertical direction) at the beginning to flexible and rhymed continuous movements. It is formed through gradual transition in each stage. Therefore, the development characteristic in each stage is very important.

TABLE II. DIVISION OF DEVELOPMENT STAGES OF ANTERIOR SLIDE MOVEMENT FOR 3~6-YEAR-OLD CHILDREN

Movement	Stage I (3~4 years old) Can run continuously	Stage II (4~6 years old) Can distinguish front and rear legs
Anterior slide	Unflexible or lack of rhythm Default running mode Rear leg is beyond front leg when it is raised and is maintained in the front place when standing down to the ground The step voice is heavy Arm movement is invalid	The movement is slow and in discontinuous rhythm Can distinguish front and rear legs Rear leg is inflexible The movement in vertical direction is exaggerated Arm can swing up and down

The 104 tested students were classified according to the two stages of the overall step sequence of the anterior slide. Then the number and percentage of

children of each age in each stage and the total number and percentage of children of each age in each stage were sorted out as shown in "Table III".

TABLE III. DEVELOPMENT SEQUENCE OF ANTERIOR SLIDE MOVEMENTS FOR 3~6-YEAR-OLD CHILDREN

Stage	Stage I				Stage II				Total
	Age	Boy	%	Girl	%	Boy	%	Girl	
3-4	9	36	10	40	5	20	1	4	25
4-5	6	20	6	20	10	33	8	27	30
5-6	12	24	15	31	12	24	10	21	49
Total	27	26	31	30	27	26	19	18	104

A. 3~4-year-old children can form the movement of stage I — discontinuous running

As can be seen from "Table III" for 3~4-year-old children, more than 70% of them are in stage I of anterior slide movement and a few of them are in stage II. This indicates that 3~4-year-old children have

initially formed this movement skill. Children at this stage show a running mode similar to the default running mode and cannot truly complete an anterior slide movement. The main movement characteristics in this stage are: the movement is inflexible or lack of rhythm; when they raise their legs looking like in movement mode of running, their rear leg is beyond

front leg, with knee bent and raised high and is maintained in the front place; when standing down to the ground, the step voice is heavy and arms on two sides of body almost have no action, showing dis-coordinated body.

Running is the basis and premise for developing continuous anterior slide skill. It is normal that most children aged 3~4 are in the stage I. They cannot keep movement coherent, as their physiological characteristics and psychological characteristics are not mature enough, their lower limbs are weak in force and their spatial displacement ability is poor and they hardly have training experience in this aspect before this stage, let alone the flexibility and sense of rhythm. Moreover, they may often get the movement evolved to running form. During the practice, children may focus on the movement mode, lacking of good practice in balance, coordination and leg strength so that are not well established, thus leading to the appearance of too heavy step voice and other forces irrelevant to the correct movement. In the earliest stage of anterior slide learning, the arm doesn't contribute much to the completion of the anterior slide.

B. 4~6-year-old children can form the movement of stage II — available to distinguish front and rear legs

As can be seen from "Table III" for 4~6-year-old children, more than 50% of them are in stage II. The transition from the first stage to the second stage is relatively rapid, and the level of children's movement skill is significantly improved at stage II. Its main movement characteristic is that children can clearly distinguish the positions of front and rear legs. In this stage, the anterior slide speed of children is slow and in discontinuous rhythm. In moving, children's rear leg is usually inflexible so that their movements in this stage become slower and more exaggerated than that in stage I. In this stage, children mainly apply the force to thrusting against the ground, accompanied by a clear lifting action of the body, rather than a forward movement. In this stage, it is often seen that two arms of children begin to assist applying force and maintaining balance. Their arm may swing up and down in an exaggerated manner to increase the upward force. Therefore, stage II is the same as stage I, and the body still dominates in the vertical direction in stage II.

Compared with stage I, children in stage II have obvious improvement in movement skill and their leg forces are also increased, but they still cannot master the skill to thrust the body to move forward and upward. They may often jump too high, their upper arms are over-lifted when they jump, and they often dance disorderly in the off-ground stage. In this stage, children may often raise their knees high. They lack the ability to use the left leg or the right leg as the guiding

leg, namely they can only get non-dominant leg placed behind and the dominant leg used as the guiding leg.

IV. ANTERIOR SLIDE MOVEMENT DEVELOPMENT OF EACH LIMB SEGMENT FOR 3~6-YEAR-OLD CHILDREN

By repeatedly observing the videos, it is found that anterior slide movement skill is mainly evolved from a series of movements of legs and arms. In order to understand the movement characteristics of each limb segment in anterior slide, this section makes relevant research in partial sequence method.

A. Anterior slide movement development characteristics of legs

Children's anterior slide movement development characteristics of legs can be seen in "Table IV".

TABLE IV. DISTRIBUTION AND MAIN CHARACTERISTICS OF LEG MOVEMENT IN ANTERIOR SLIDE FOR DIFFERENT AGES OF CHILDREN

Limb segment movement	Age interval	Movement characteristics
Leg movement	3-4	L1: when they raise their legs looking like in movement mode of running, their rear legs are beyond front legs, with knees bent and raised high; when standing down to the ground, the step voice is heavy.
	4-6	L2: rear leg is placed beside or slightly behind front leg when landing on the ground; rear leg is usually very unflexible so that hip inclines toward side of body and body is moved upward rather than forward.

The leg movements of 104 tested 3~6-year-old children in anterior slide were classified according to gender and age. Then the number and percentage of children of each age in each development sequence and the total number and percentage of children of each age in each development sequence were sorted out as shown in "Table V".

TABLE V. DEVELOPMENT SEQUENCES OF LEG MOVEMENTS IN ANTERIOR SLIDE

Sequence Age	L1				L2			
	Boy	%	Girl	%	Boy	%	Girl	%
3-4	9	36	9	36	5	20	2	8
4-5	7	23	6	20	9	30	8	27
5-6	6	12	5	17	18	37	20	41
Total	28	27	22	21	33	32	30	29

It can be seen from "Table V" that more than 70% children aged 3~4 have L1 characteristics, wherein there are 9 boys accounting for 36% and 9 girls

accounting for 36%. More and more children aged more than 4 have L2 characteristics, wherein there are 9 boys accounting for 30% and 8 girls accounting for 27%. 3~4-year-old children have few opportunities to get in touch with the skills similar to anterior slide movement. So at the beginning, it is difficult for them to grasp the main points of the movement. However, running is the first displacement skill to be mastered for children, a very common activity in China and is involved in most children's games, dances and other activities. Therefore, in the age of 3~4 years old, children's leg movement in doing anterior slide is similar to the running mode; in the age of 4~6 years old, children's such skill level is improved somewhat, they have initially mastered the skill of anterior slide and their leg force is significantly stronger than that in the previous stage.

B. Anterior slide movement development characteristics of arms

Children's anterior slide movement development characteristics of arms can be seen in "Table VI".

TABLE VI. DISTRIBUTION AND MAIN CHARACTERISTICS OF ARM MOVEMENT IN ANTERIOR SLIDE FOR DIFFERENT AGES OF CHILDREN

Limb segment movement	Age interval	Movement characteristics
Arm movement	3-5	A1: The two sides do not move, the arm has almost no movement and has no effect on the slide and jump.
	5-6	A2: Swing up and down.

The arm movements of 104 tested 3~6-year-old children in anterior slide were classified according to gender and age. Then the number and percentage of children of each age in each development sequence and the total number and percentage of children of each age in each development sequence were sorted out as shown in "Table VII".

TABLE VII. DEVELOPMENT SEQUENCES OF ARM MOVEMENTS IN ANTERIOR SLIDE

Sequence Age	A1				A2			
	Boy	%	Girl	%	Boy	%	Girl	%
3-4	11	44	10	40	3	12	1	4
4-5	9	30	8	27	7	23	6	20
5-6	5	10	8	16	19	39	17	35
Total	25	24	26	25	29	28	24	23

It can be seen from "Table VII" that the proportion of number of children having A1 characteristics is decreased from the more than 80% in age of 3~4 to the 57% in age of 4~5. The proportion of number of children having A2 characteristics reaches more than

60% in the age of 5~6, namely they have form A2 characteristics since age of 5. According to development rules of children, for 3~5-year-old children, they may potentially protect themselves from falling down in the process of jump and slide and their placing arms on two sides of body is to keep the body balanced. So in this stage, arm is mainly used for maintaining balance, they cannot use two arms to assist exert some force so the development of coordination ability doesn't exist in this stage. for 3~5-year-old children, partial of them can have small extent of upward and downward swinging of arm and cannot fully stretch their arms; when they raise their legs in the air, their knees are bent and raised high from the ground, with arm swinging disorderly in the air to keep the body balanced to get rid of sense of terror; correspondingly, their arms swinging extent is over exaggerated, showing a clumsy and dis-coordinated movement. In this stage, their arm movement is largely improved compared to that in the last stage and their arms and legs begin to coordinate and exert forces.

V. CONCLUSION

First, the movement characteristics of entire slide of 3~6-year-old children can be divided into two stages such as intermittent running (in 3~4 years old) and being available to clearly distinguish front and rear legs (in 4~6 years old).

Second, the movement characteristics of each limb segment of 3~6-year-old children can be divided into leg movement development sequence and arm movement development sequence, wherein the former sequence is developed from being able to get rear leg moved beyond front leg (in 3~4 years old) to being able to get rear leg placed beside front leg (in 4~6 years old) and the latter sequence is developed from being able to keep two sides unmoved (in 3~5 years old) to being able to move arm up and down (in 5~6 years old).

Third, children's anterior slide movement may become more and more proficient with age increase, but it is not developed at a constant rate according to age.

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