

## Integral method for the development of motor abilities and psycho-physiological functions in children from 2 to 4 years old

ZHANNETA KOZINA<sup>1,2</sup>, IVAN PROKOPENKO<sup>2</sup>, OLENA LAHNO<sup>3</sup>, SERGII KOZIN<sup>4</sup>, TATYANA RAZUMENKO<sup>2</sup>, ANDRII OSIPTSOV<sup>5</sup>

<sup>1</sup>National Research University "Belgorod State University", RUSSIA

<sup>2</sup>Kharkiv National Pedagogical University, UKRAINE

<sup>3</sup>Pridneprovsk National Academy of Building and Architecture, UKRAINE

<sup>4</sup>National Technical University "Kharkiv Polytechnic Institute", UKRAINE

<sup>5</sup>Mariupol state University, UKRAINE

Published online: March 30, 2018

(Accepted for publication January 05, 2018)

DOI:10.7752/jpes.2018.01001

### Abstract:

*The aim of the work:* to develop and substantiate the method of integral development of the child on the basis of the integrated application of poems about nature and imitation movements. *Material and methods.* There are 108 children involved in the study. Among them were 56 children who are 2 and 3 years old (28 were in control group and 28 were in experimental group), 52 children who are 3 and 4 years old (24 were in control group and 28 were in experimental group). *Measures.* Anthropometry (body length (kg), body weight (m)), motor tests, psychophysiological indices, an expert evaluation of the speech. *Methods for determination of motor abilities.* To monitoring the state of general physical fitness of children 2 years was used run 10 m (c). To monitoring the state of general physical fitness of children 3-4 years, the following tests were applied: running 10 m (s), jump in length from place (m), throwing a bag of sand with a weight of 40 g (m), balance time at one leg (s). *Methods of psychophysiological testing.* Psychophysiological indicators reflect the speed of thought processes on the basis of determining the speed of impulses in the central nervous system. The following measurements were made: measurement of the simple reaction speed to the light stimulus: in response to the appearance of any image on the monitor, it was necessary to press and release the left mouse button as soon as possible; measurement of the simple reaction speed to the sound stimulus: in response to the sound, you should press and release the left mouse button as soon as possible. Comprehensive application of poems about nature and exercises contributed to an increase in the development of psychomotor abilities of children 2-4 years. The essence of the technique is to perform exercises not under the expense, but under verse lines about nature; Each line of the verse corresponds to physical exercise. In addition, in these techniques, an original sequence of movements that flow smoothly from each other and built on the natural movements of the child, carried out immediately all over the body on the principle of animal imitation, as well as - by wave principle. *Results.* The complex application of poems about nature and exercises contributed to an increase in the development of psychomotor abilities of children 2-4 years old. In the age group of 2 years, the most significant changes occurred in the times of a simple reaction to light and sound. The running time of the 10 m segment significantly improved both in the control and in the experimental groups, however, in the experimental group the change in this index is more pronounced. In the experimental group also more pronounced verbal develop as a result of the application of the technique. In the age group 3-4 years, a significant improvement in the parameters of a simple reaction to light and sound stimuli was revealed. Significantly improved the performance of throwing a bag with sand right hand, a long jump from the seat. In the control group, these changes are less pronounced or unreliable. The development of speech significantly changed both in the experimental group and in the control group, but in the control group these changes were more pronounced. *Conclusions.* A greater number of significant differences were found between the test scores of the children of the experimental group compared with the control group after the experiment. It is recommended to use the integral technique of combining poems about nature and movements for the development of psychomotor abilities of children 2-4 years old.

**Key words:** psychomotor development, small children, movements, verses about the approach.

### Introduction

The modern world requires not only high physical training, but also the development of the psyche and intellect (de Raeymaecker, 2006; Feder & Majnemer, 2007; Kotsopoulos, Makosz, & Zambrzycka, 2017). So, development of intellectual and psychic abilities needs to be raised from the childhood. For this, it is necessary to develop simple, accessible; harmoniously developing physically, intellectually and psychologically, methods. Technologies that allow dealing with children from an early age are of particular relevance.

Integral development of the child is often implied in the definition of psychomotor development (François & des Portes, 2004; de Raeymaecker, 2006, Feder & Majnemer, 2007). The child's psychomotor development reflects the formation of different parts of the child's nervous system at certain periods of life.

Main criterias of psychomotor development: 1. Development of motility: a range of manipulative activities of the child, from large motor skills to fine motor skills; 2. Sensory reactions: responding to light, sound, touch; 3. Language development: expressive speech and understanding of the language; 4. Emotional and social development. Psychomotor development of the child largely characterizes the functional state of the nervous system and the musculoskeletal system.

The idea of integral development of children is shown in the work of Jeppsson, Frejdand Lundmark (2017). The authors showed that with the help of an infrared camera, children can integrate their sensations and comprehend the physical concepts of heat, temperature and friction. In this study, children 7-8 years old participated. The authors show that children try to compare different concepts and form representations, based on a holistic perception of the world through associations. It is logical to presume that the integral nature of perception is also characteristic of younger children. Therefore, the education of children should be built on their high ability to holistic perception of the world. This requires the use of appropriate tools and training methods.

The work of Lanphear and Vandermaas-Peeler (2017) is also devoted to the development of children's perception. The authors showed that through social cooperation and mutual orientation, children coordinate the understanding of the world. This work shows that the child's perception of the world is integral. Therefore, the greatest effect should be expected from the application of methods of integral impact on various aspects of child development.

The Hancock (2017) shows the need for applying global citizenship programs in preschool to form a child's self-image as a part of the world society. The author points out that the introduction of such programs can prevent the formation of negative ideas about themselves in children. This is particularly true for African American children. The author shows the need for global education of children, from an early age. This also implies the development of special methods for the integral perception of the world. Allhusen et al. (2007) showed that the age of admission to preschool only affects some of the cognitive abilities of children in the early stages of education. Further, these differences are smoothed out. The children who went to preschool later, define their peers on many indicators of cognitive development. This indicates the high importance of family upbringing of the child. For this, development of appropriate methods is necessary. Pop (2016) shows the perniciousness of a sedentary lifestyle. From the researches carried out by the author it follows that it is necessary to form the need for movement and the skills of owning various motor actions from early childhood. This will create the basis for adequate motor activity at an older age.

Bondarenko (2017) showed the need to strengthen the muscles of the trunk muscles for the development of static endurance. This is especially necessary for six-year-olds who started school. Svystun, Trach, Shavel and Kukujuk (2017) showed the need for physical exercises with children in a safe zone of intense motor activity. Petrenko (2016) showed the influence of speech development on the cognitive functions of preschool children and suggested a technique for the use of dances for the speech development of children.

Proceeding from the analysis of the problem of the need to use means of integral influence on various aspects of child development, it is worth mentioning the main points revealed in the literature: the need for family upbringing; the need to engage parents with children (Neumann, 2017); the need for a comprehensive use of multidirectional means for the development of speech (Petrenko & Filippov, 2017), activation of cognitive functions, development of artistic abilities, development of motor abilities (Barnett, van Beurden, Morgan, et al. 2009; Cools, De Martelaer, Vandaele, Samaey, & Andries, 2010; D'Hondt & Deforche, 2009). To implement a diversified development of the child, it is necessary to attract specialists from various fields. However, it is difficult to combine this with the need for family education and conducting classes for parents with children.

Therefore, the question arises: is it possible to create an integral methodology that combines the child's verbal, mental, physical development? Can this technique be sufficiently accessible in mastering and carrying out so that it can be used not only by educators, but also by ordinary parents? Thus, it is urgent to search for or develop and apply an effective technique that combines the possibility of a child's psychomotor (motor, speech, sensory) development. At the same time, it should be sufficiently accessible, effective, do not take a lot of time, like children and adults working with them.

We assume that such a technique can be a combination of special **verses** and movements aimed at imitating the actions of various animals and natural phenomena.

The aim: to develop and substantiate the method of integral development of the child on the basis of the integrated application of **verses** about nature and imitation movements.

## **Material and method**

### *Participants*

The aim is to evaluate the effectiveness of integrated psychomotor development of children in the age from 2 to 4. There are 108 children involved in the study. Among them were 56 children who are 2 years old (28 were in control group and 28 were in experimental group), 52 children who are 3 and 4 years old (24 were in

control group and 28 were in experimental group). During the experiment in the kindergarten-nursery № 309 "Zernyatko" in Dnibr (Ukraine). The control group was working in accordance with the basic program. The experimental group used the developed technique.

All studies were carried out in accordance with the principles of the Helsinki Declaration and approved by the Ethics Committee of the University.

#### *Procedure*

These lessons were three times a week for both groups. The duration of them was the same. Children who are 2 years old had from 10 to 20 minutes; who are 3 and 4 years old had from 20 to 25 minutes; who are 4 and 5 years old had from 25 to 30 minutes. The duration of the pedagogical experiment was 6 months. During the first three lessons, children were tested. Then within 6 months the children of the experimental group mastered the technique of performing exercises for verses. The control group was working in accordance with the basic program. Children of the control group performed similar exercises without using poems.

Testing was carried out before and after the experiment.

#### *Measures*

The method of anthropometry is used to determine the level of physical development of children 2-4 years. The length of the body was measured with the help of a stadiometer accurate to 0.01 m.

The body weight was determined by weighing, which was performed on tithing medical essays with an accuracy of 100 g. (D'Hondt & Deforche, 2009).

**Methods for determination of motor abilities** (Fisher et al., 2005), Lahno, Hanjukova, & Cherniavska, 2015; Lahno, 2017).

To monitoring the state of general physical fitness of children 2 years was used run 10 m (c).

To monitoring the state of general physical fitness of children 3-4 years, the following tests were applied:

- running 10 m (s)
- jump in length from place (m)
- throwing a bag of sand with a weight of 40 g (m)
- balance time at one leg (s)

#### **Organization of testing**

To determine the speed of running a section of 10 m at the start, along with the child was a mentor. At a distance of 10 m, at the finish, with a stopwatch was the second educator, and another 2-3 m stood a toy. The child had to run to the toy.

With children of early childhood (2 years) at several classes before testing, the tutor ran across the entire distance, then gradually during 3 classes the baby independently, without taking into account the time, ran a distance of 5, 7 and 10 meters. After mastering the content of the task, testing was carried out.

For children 3-4 years was also determined the level of development of speed-strength abilities. For this purpose, a throwing bag with sand weighing 40 g (m) was used. The baby was given a bag. We had to throw the bag as it was possible. The child stood near a certain line. The line was not allowed to step over. Determine the distance throwing.

Also applied was the jump in length from the place (m). The child became a definite line. We had to jump as far as possible with the push of two legs. The result of the jump was determined.

To determine the level of development of coordination abilities, the ability to maintain a static equilibrium on one leg (c) was determined. The child was asked to stand one leg, bent in the knee, 20-30 cm from the floor and stand on the second leg. Time was determined until the loss of balance and touching the bent leg of the floor (Kozina et al., 2017).

#### **Methods of psychophysiological testing.**

Psychophysiological indicators reflect the speed of thought processes on the basis of determining the speed of impulses in the central nervous system. The speed of processing external signals by the nervous system is an indirect indicator of the development of mental functions. Psychophysiological functions are the basis of psychomotor development. In this study, methods were used to determine the psychophysiological abilities in terms of time indicators of a simple and complex reaction. Tests were conducted on the computer program "Psychodiagnostics" (Kozina et al., 2016).

There is a large number of analogues of this program, for example DirectRT, MediaLab (Karia, Ghuntla, Mehta, Gokhale, & Shah, 2012) and others.

The following measurements were made:

- Measurement of the simple reaction speed to the light stimulus: in response to the appearance of any image on the monitor, it was necessary to press and release the left mouse button as soon as possible;
- Measurement of the simple reaction speed to the sound stimulus: in response to the sound, you should press and release the left mouse button as soon as possible.

### ***Organization of testing.***

For children 2 years were created comfortable conditions. Testing was carried out directly in the group where the child is brought up. The kid, sitting on the hands of a tutor, first got acquainted with the computer, did a few training attempts and then, at a good emotional and psychological mood fulfilled the test tasks. If the child's mood was negative, then the testing was carried out or conducted with parents and educator.

Children 3-4 years of life did not need such conditions. They performed the task independently in the presence of the educator.

1. *Simple reaction to light signal.* In the process of testing, black spots on the computer screen appear on the computer screen, which the child must respond by pressing the spacebar (before the end of the test). The average response time from 25 attempts (ms) is fixed, as well as the index of individual stability of the reaction rate by the coefficient of variation (cV; c.u.) for each subject. The closer the oscillation coefficient approaches to zero, the higher the individual stability of the reaction rate.

2. *Simple response to the sound signal.* In the process of testing, there is a sound with a frequency of 2-3 KHz and a force of 55-60 dB, which must be reacted by pressing the spacebar. The average response time from 25 attempts is fixed, as well as the index of individual stability of the reaction rate by the coefficient of variation (cV; c.u.) for each subject. The closer the oscillation coefficient approaches to zero, the higher the individual stability of the reaction rate.

### ***Speech assessment***

The child's speech was assessed on a 10-point scale with the help of peer review by independent observers. In this scale 1 there was a low quality development, 10 - the highest.

The scale was constructed in the following way:

- 1 - the child does not utter individual words: pronounces only individual sounds;
- 2 - the child pronounces 2-5 simple words;
- 3 - the child pronounces 10-20 words; pronunciation is incorrect in most words;
- 4 - the child pronounces up to 50 words, at least 10 words the child pronounces correctly;
- 5 - the child pronounces up to 200 words, at least 20 words pronounces correctly, tries to construct simple sentences;
- 6 - the child speaks about 200 words, constructs simple sentences;
- 7 - the child speaks about 500 words, tries to build complex sentences;
- 8 - the child speaks more than 1000 words, builds complex sentences;
- 9 - the child speaks more than 1500 words, freely constructs complex sentences; his speech is understandable to strangers;
- 10 - the child freely expresses his thoughts with simple and complex sentences, his speech is understandable to strangers.

In total, 5 experts were invited. Experts watched the children in the kindergarten for 2 hours during walks. Also, the experts observed the children while communicating with their parents for 2 hours. The presence of experts was not noticeable for children. The observation was conducted for 5 days. At supervision of children simultaneously there were no more than 2 experts. Experts' assessments were generalized. The average expert judgment was calculated.

### ***Methods of mathematical statistics***

The results obtained during the study were calculated using mathematical statistics.

Calculated: mean values of ( $\bar{x}$ ), average error (m), mean square deviation (S), coefficient of variation (V). The significance level (p) was taken at 0.05. Intergroup differences and their reliability (Student's criterion; t) were determined. Data processing of quantitative indicators of physical development, physical preparedness and psycho-physiological features was carried out using standard packages MS Excel, SPSS.

**Method of integral application of poems about nature and exercise** (Kozina & Kozin, 2009; Kozina & Kozin, 2017).

The essence of the technique is to perform exercises not under the expense, but under verse lines about nature; Each line of the verse corresponds to physical exercise. In addition, in these techniques, an original sequence of movements that flow smoothly from each other and built on the natural movements of the child, carried out immediately all over the body on the principle of animal imitation, as well as - by wave principle.

### ***Pedagogical features of gymnastics in verse "Little wizards":***

1. Comprehensive development of the child, starting from 1 year, by performing exercises on the given verse images;
2. Education of a sustainable need for physical education, beginning at an early age;
3. Improvement of the child's natural movements by performing exercises like the imitation of animals, according to the principle of undulating movements (Kozina & Kozin, 2009);

4. The possibility of holding gymnastics by parents and non-specialists in the field of physical education, i.e. accessibility of the methodology, ease of its development and implementation.

***Methodical features of gymnastics in the verses "Little Wizards":***

1. The presence of a sufficiently large number of exercises (48) for the age group from 2 to 4 years.  
2. The construction of exercises on the principle of alternating heavy with light, purely imitating. This allows you to alternate the load and rest at fairly short intervals and is the most acceptable form of employment with children 2-4 years old.

3. Learning and performing exercises in a holistic manner, at once with the whole body, without breaking up into separate segments, which is most natural for the specified age group.

4. The construction of movements by the principle of imitation of animals, which facilitates the perception of exercises by young children, activates both ancient and relatively new brain structures, develops artistry, plasticity, expands the boundaries of perception of the world.

5. Exercise is not under the account, and under the verse images, which is most acceptable for children from 1 year, contributes to the development of the mind and intellect along with physical development due to the activation of a large number of brain structures, reduces the feeling of fatigue, saturates emotionally, doing gymnastics very attractive for children and adults.

***Verses of the complex (fragment)*** (Kozina & Kozin, 2009; Kozina & Kozin, 2017).

1. In the sky the sun sends rays
2. Strong wind weaves green grass
3. Water in the stream murmurs
4. A furry fox tail quickly swings
5. A snail crawls along the sheet
6. The lizard climbs quickly-quick
7. An Elephant is nodding head
8. A squirrel is catching own tail
9. A bear is raking big roots
10. A hen is scraping leaves with feet
11. The forest cat loves catching fish:
12. Grabs with the paw – and at once eats
13. In the river duck swims
14. In the grass the snake creeps
15. Quickly frog is jumping
16. Bunny Ears are Raising
17. Quietly the butterfly sits
18. Under the water fishes sleeps
19. The sparrow jumps and tweets
20. A crow walks and something finds
21. On the snow goes a little penguin
22. In the blue sea floats the dolphin
23. The young rabbits jumping- jumping
24. With his back leg scratches puppy
25. The mouse quietly-quietly sits
26. The bear at lair fastly sleeps
27. Kitty woke up, Back the bends
28. Little kitten is washing ears

**Description and illustration of exercises**

***1. In the sky the sun sends rays***

Standing straight, raise the handles upwards and slightly spread them to the sides, as if enveloping the sun (Figure 1 (1)). Walk in a circle for 1-2 minutes.

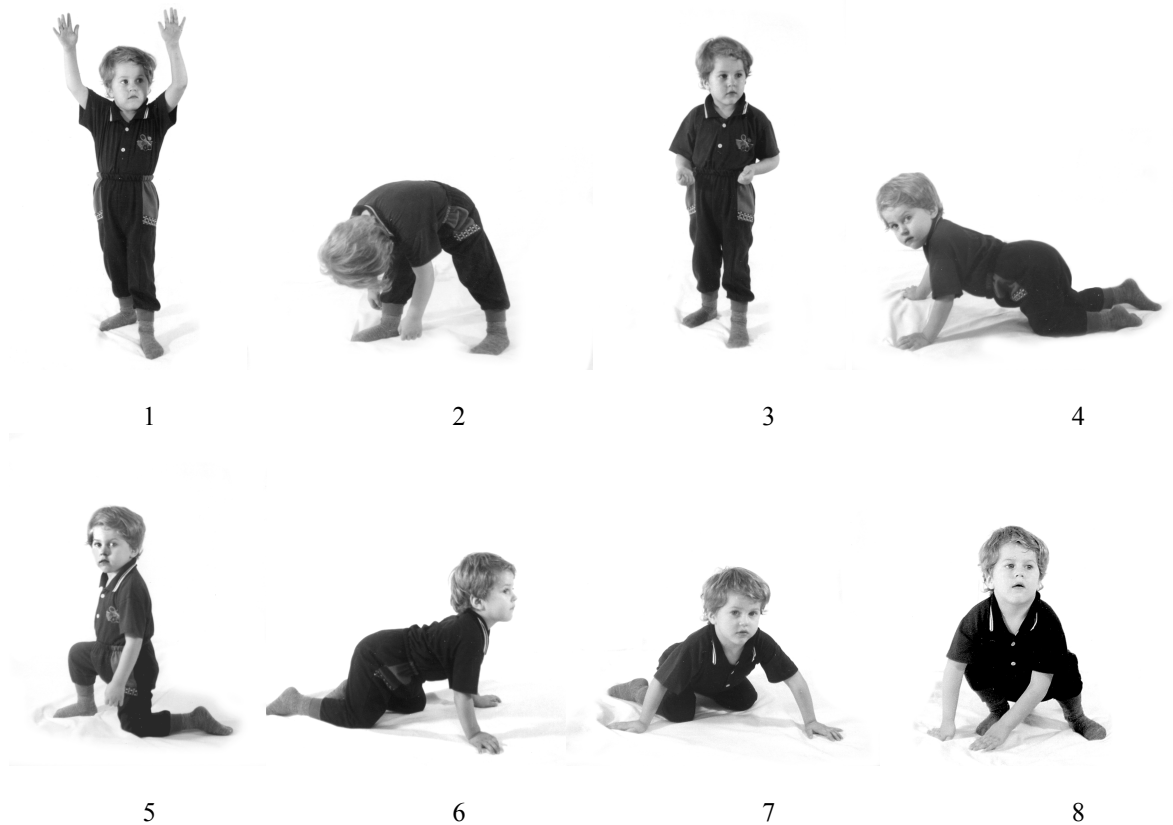


Fig. 1. Illustration of exercises 1-8 (source: photos of the author, Kozina Z.)

**2. Strong wind weaves green grass**

Put one leg forward, lift handles up. Lean forward, slightly bending the front of the standing leg in the knee. To make the movements of the handles and the device back and forth 5-10 times, imitating how the wind blows the grass (Figure 1(2)).

**3. Water in the stream murmurs**

The legs should be placed apart, the handles bent at the elbows (Figure 2 (3)). Move forward-backward with handles with pivot turns for 0.5-2 minutes.

**4. A furry fox tail quickly swings**

Become on all fours, rotate the pelvis in all directions for 0.5-2 minutes (Figure 1 (4)). It is necessary to emphasize raising the coccyx, like a tail in a chanterelle. This exercise helps normalize many life processes.

**5. A snail crawls along the sheet**

Stand with one leg on the knee. To walk with the other leg, pulling the bent knee 5-10 times (Figure 2 (5)). Then change the legs and repeat. This exercise strengthens the ankle and knee joints, develops diligence and patience.

**6. The lizard climbs quickly-quick**

Stand on all fours and quickly - move quickly 0.5-2 minutes (Figure 1 (6)).

**7. An Elephant is nodding head**

Standing on all fours, it's slow and important to nod your head in different directions 5-10 times (Figure 1 (7)).

**8. A squirrel is catching own tail**

Sitting down. Handles lean on the floor. Jumping the legs around the handles. Move the handles. Again, jump the legs, etc. 5-15 times (Figure 1 (8)).

**9. A bear is raking big roots**

Sitting down. Do rake movements with handles on the floor, imitating the cops with bear roots 0.5-2 min (Figure 2 (9)).

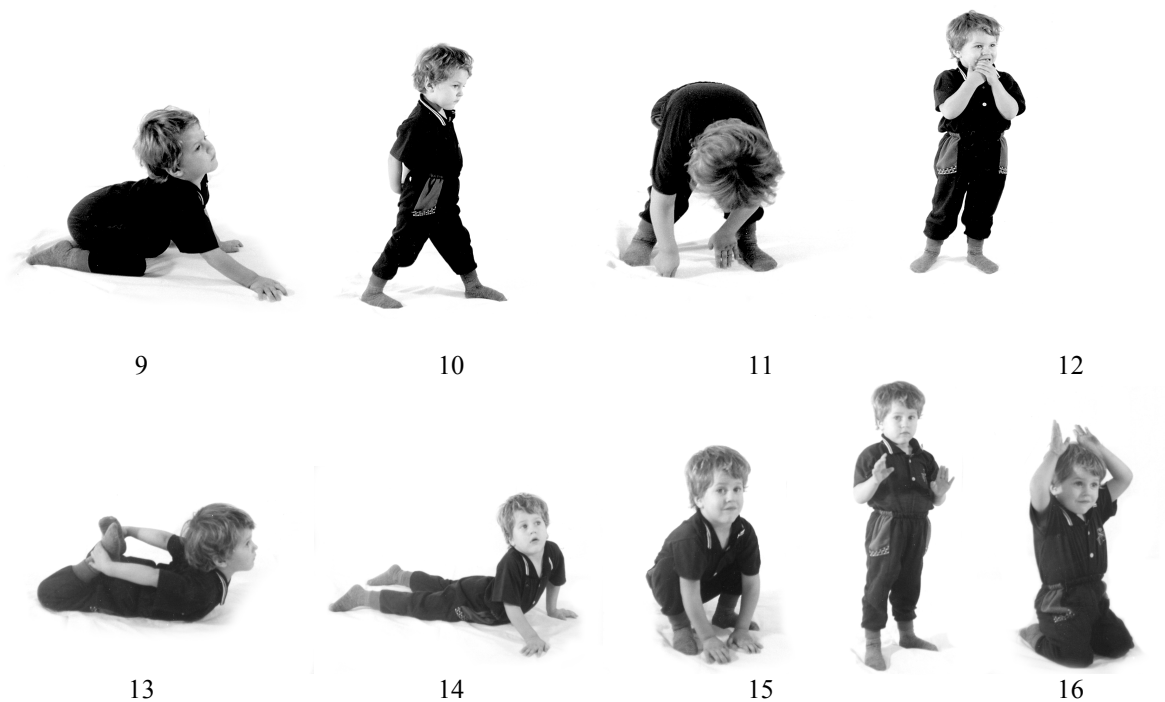


Fig. 2. Illustration of exercises 9-16 (source: photos of the author, Kozina Z.)



Fig. 3. Illustration of exercises 21-24 (source: photos of the author, Kozina Z.)



Fig. 4. Illustration of exercises 21-24 (source: photos of the author, Kozina Z.)

**10. A hen is scraping leaves with feet**

While standing, do the raking movements with the legs for 0.5-2 minutes (Figure 2 (10)). It is necessary to strive to make as wide a foot as possible, while maintaining equality.

**11. The forest cat loves catching fish:**

**12. Grabs with the paw – and at once eats**

Sharply sit down, make a grasping movement with a pen, stand up, simulate eating food (Figure 2 (11-12)). Repeat 5-10 times.

**13. In the river duck swims**

Lie down on the tummy, bend the legs in the knees, grasp the legs of the genital joints, raise the head, bend and roll back and forth 5-10 times (Figure 2 (13)).

**14. In the grass the snake creeps**

a) Lie on your tummy, put the palms down at the shoulders in front of you. Unbend the knobs, bend, look to the right - to the left (Figure 2 (14)). To be in this position 1-2 min.

b) The same, but the pens are connected behind the back. Hold this position for as long as possible. Repeat 2-3 times.

**15. Quickly frog is jumping**

Sitting down (Figure 2 (15)). Jump forward, having unbent legs in the knees (Figure 2(15)) and land again in the squat position. Jump again, etc. 5-10 times or at will. As the child's preparedness improves, the number of jumps can be increased up to 20-30 times at the child's discretion or performed 5-10 times in series.

**16. Bunny Ears are Raising**

To sit on your knees, to simulate with your hands the ears on your head for 1-2 minutes (Figure 2 (16)). This exercise - rest after the load of the previous exercise.

**17. Quietly the butterfly sits**

Sit down, connect the feet at the perineum. Dilute your knees, trying to touch their sex (Figure 3 (17)). Perform for 0.5-2 minutes.

**18. Under the water fishes sleeps**

a) Sit on your knees, then slowly lie on your back.

b) Sit on the hips, bending the legs in the knees, push the feet closer to the buttocks. Slowly lie on your back (Figure 3 (18)). Carry out 0.5-2 minutes.

**19. The sparrow jumps and tweets**

Jump in the squat position, imitating handles waving the eyes of the sparrows, 5-10 times (Figure 3 (19)).

**20. A crow walks and something finds**

Stand up, handles behind your back. Step forward with straight legs with slopes for each step (Figure 3 (20)). At the inclinations only the pelvic region is bent, the lumbar and the thoracic spine remain straight. Run 10-15 steps with inclines.

**21. On the snow goes a little penguin**

Go, making wave-like movements of handles and trunk 0.5-2 min (Figure 4 (21)).

**22. In the blue sea floats the dolphin**

Go small steps, putting feet apart and not bending the knees in the knees. Keep the handles straight along the trunk, pulling the hands apart (Figure 4 (22)).

**23. The young rabbits Jumping- jumping**

Sitting down. Lean with handles in front of the floor. Jump the legs to the handles with a jump. Move the knobs forward. Again, jump up the legs with a jump. Repeat 5-10 times (Figure 4 (23)).

**24. With his back leg scratches puppy**

Sit down. Take the handle of the foot and scratch it behind the ear or any other place on the head (Figure 4 (24)). Repeat with the other foot. Perform 0.5-1 minutes with each leg.

**25. The mouse quietly-quietly sits**

Sit on your knees, then lie down on your hips with your tummy, head to the floor. Handles along the trunk (Figure 5 (25)). It is in this position 0,5-2 min.

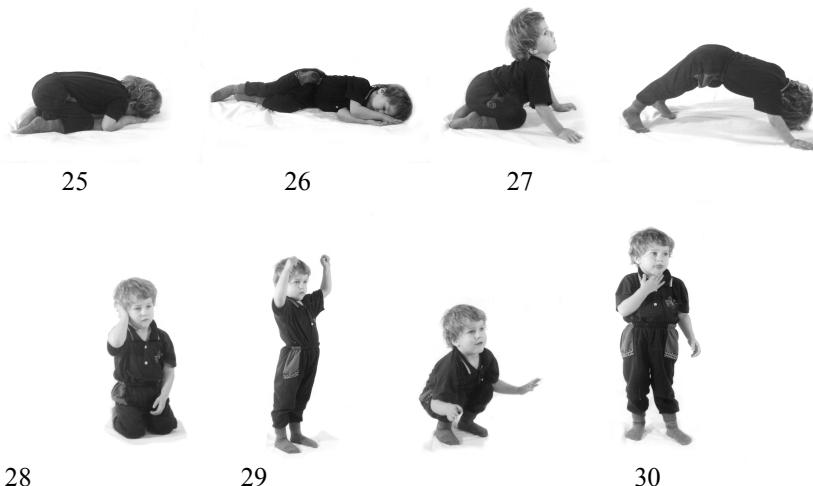


Fig. 5. Illustration of exercises 25-30 (source: photos of the author, Kozina Z.)



**26. The bear at lair fastly sleeps**

Lie on the side (Figure 5 (26)). Imitate snoring 0.5-2 minutes.

**27. Kitty woke up, Back the bends**

Get down on your knees, put your hands on the floor. Bend the backrest, lower the head (Figure 5 (27)). Then, bend the backrest, raise the head. Repeat 5-10 times.

**28. Little kitten is washing ears**

To sit on your knees, do massage of the ears (Figure 5 (28)) 0,5-2 min.

**Results**

**Evaluation of the effectiveness of integral psychomotor development for children 2 years**

Before the experiment, the control and experimental groups did not differ significantly in terms of psychomotor development. Indicators of physical, psycho-physiological development and physical fitness of children of the control and experimental groups for the experiment have no significant differences (Table 1).

Table 1.Indices of psychomotor development of children 2 years of control and experimental groups before the experiment (n = 28)

Indexes	Group	Statistical values of indicators				
		$\bar{x}$	S	m	t	p
Body weight, kg	experimental	14,85	1,54	0,29	-0,67	>0,05
	control	15,1	1,24	0,23		
Body length, m	experimental	0,93	0,054	0,01	-1,59	>0,05
	control	0,95	0,039	0,01		
Response time to light irritant, ms	experimental	1463,93	85,65	16,19	0,49	>0,05
	control	1452,79	83,89	15,85		
Stability of the reaction to the light stimulus, the coefficient of variation of the individual values of the time of the fraction, cV, c.u.	experimental	13,46	3,97	0,75	0,39	>0,05
	control	13,07	3,55	0,67		
Response time to sound stimulus, ms	experimental	1273,89	53,34	10,08	-0,37	>0,05
	control	1278,64	42,51	8,03		
Stability of reaction to sound stimulus, coefficient of variation of individual values of time of a particle, cV, c.u.	experimental	11,48	3,02	0,57	1,47	>0,05
	control	10,47	2,01	0,0,38		
Running 10 m,s	experimental	4,11	0,55	0,10	0,09	>0,05
	control	4,10	0,15	0,03		
	experimental	3,52	0,53	0,10		
Score speech, points	control	3,56	0,42	0,08	-0,31	>0,05

Table 2.Indices of psychomotor development of children 2 years of control and experimental group after the experiment (n=28)

Indexes	Group	Statistical values of indicators				
		$\bar{x}$	S	m	t	p
Body weight, kg	experimental	15,74*	1,64	0,31	0,40	>0,05
	control	15,56	1,72	0,33		
Body length, m	experimental	0,97*	0,056	0,01	-1,59	>0,05
	control	0,99*	0,036	0,01		
Response time to light irritant, ms	experimental	1110,25***	40,62	7,68	-27,85	<0,001
	control	1448,21	49,74	9,4		
Stability of the reaction to the light stimulus, the coefficient of variation of the individual values of the time of the fraction, cV, c.u.	experimental	9,65**	1,08	0,20	-5,73	<0,001
	control	11,32*	1,1	0,21		
Response time to sound stimulus, ms	experimental	1030,36***	38,27	7,23	-18,98	<0,001

	control	1242,57*	45,10	8,52		
Stability of reaction to sound stimulus, coefficient of variation of individual values of time of a particle, cV, c.u.	experimental	7,35***	1,99	0,38		
	control	10,43	2,52	0,48	-5,08	<0,001
Running 10 m,s	experimental	3,75*	0,44	0,08		
	control	3,83*	0,18	0,03	-0,89	>0,05
Score speech, points	experimental	4,47***	0,23	0,04		
	control	3,86*	0,45	0,09	6,39	<0,001

Note: \* - changes in the group as a result of the experiment are reliable at  $p < 0.05$ ; \*\* - changes in the group as a result of the experiment are reliable at  $p < 0.01$ ; \*\*\* - changes in the group as a result of the experiment are significant for  $p < 0.001$ .

As a result of the experiment in the age group of 2 years, the most significant changes occurred in the time indices of the simple reaction to light and sound (in the experimental group there was a significant decrease in latency of the reaction time to light and to sound at  $p < 0,001$ , a significant improvement in the stability of the response to the sound stimulus at  $p < 0,001$ , to the light stimulus at  $p < 0,01$ ; the control group experienced a deterioration of the response time to the light stimulus at  $p < 0,05$ ).

The time for running the 10m has improved significantly in both the control and experimental groups, but in the experimental group, the change of this indicator is more pronounced: 4.11 seconds before the experiment and 3.75 seconds after the experiment, and in the control - 4.10 seconds before experiment and 3.83 seconds after the experiment (Table 1, 2).

The development of speech in children of the experimental group was more pronounced in comparison with the control (Table 1, 2)

#### ***Application of integral psychomotor development system for children 3-4 years old***

Indicators of testing physical development, psychophysiological abilities and physical fitness of children in the 3rd - 4th years of life of the control and experimental groups until the experiment did not differ significantly (Table 3).

Table 3. Indicators of psychomotor development of children 3-4 years of control (n = 24) and experimental (n = 28) groups before the experiment

Indexes	Group	Statistical values of indicators				
		$\bar{x}$	S	m	t	p
Body weight, kg	experimental	17,60	2,06	0,39		
	control	17,70	2,08	0,42	-0,17	>0,05
Body length, m	experimental	1,05	0,04	0,01		
	control	1,04	0,042	0,01	0,87	>0,05
Response time to light irritant, ms	experimental	906,71	21,86	4,13		
	control	898,29	28,95	5,91	1,17	>0,05
Stability of the reaction to the light stimulus, the coefficient of variation of the individual values of the time of the fraction, cV, c.u.	experimental	8,52	1,1	0,21		
	control	8,69	1,13	0,23	-0,55	>0,05
Response time to sound stimulus, ms	experimental	840,93	28,80	5,44		
	control	832,75	26,82	5,47	1,06	>0,05
Stability of reaction to sound stimulus, coefficient of variation of individual values of time of a particle, cV, c.u.	experimental	8,47	1,02	0,19		
	control	8,46	1,4	0,29	0,03	>0,05
Throwing a bag of sand with the right hand, m	experimental	2,56	0,59	0,11		
	control	2,59	0,62	0,13	-0,18	>0,05
Throwing a bag of sand with the left hand, m	experimental	2,33	0,64	0,12		
	control	2,38	0,65	0,13	-0,28	>0,05
Running 10 m,s	experimental	3,53	0,43	0,08		
	control	3,51	0,50	0,10	-0,15	>0,05
Leap length from place, m	experimental	0,64	0,12	0,02		
	control	0,69	0,11	0,02	-1,57	>0,05
Time to run the test on equilibrium, s	experimental	8,47	1,42	0,27		
	control	7,95	1,34	0,27	1,36	>0,05
Score speech, points	experimental	6,17	1,27	0,24		
	control	6,25	1,24	0,25	-0,23	>0,05

After the experiment, all test parameters in the experimental group changed more than in the control group.

The control and experimental group, which did not differ significantly in the majority of test indicators, after the experiment began to differ significantly among themselves in terms of the latency time of the reaction to the light stimulus ( $p < 0.001$ ), the indicators of stability of the reaction to the light stimulus ( $p < 0.001$ ), latency time the response to the sound stimulus ( $p < 0.001$ ), the stability of the response to the sound stimulus ( $p < 0,01$ ), the run of 10 m ( $p < 0,05$ ), the test on equilibrium ( $p < 0,05$ ), score speech ( $p < 0,05$ ) (tabl. 4).

Table 4. Indicators of psychomotor development of children 3-4 years of control (n = 24) and experimental (n = 28) groups after the experiment

Indexes	Group	Statistical values of indicators				
		$\bar{x}$	S	m	t	p
Body weight, kg	experimental	18,42	2,39	0,45	0,52	>0,05
	control	18,10	2,02	0,41		
Body length, m	experimental	1,086*	0,041	0,007	1,25	>0,05
	control	1,07*	0,05	0,001		
Response time to light irritant, ms	experimental	735,79***	14,95	2,39	-18,78	<0,001
	control	849,54*	26,24	2,31		
Stability of the reaction to the light stimulus, the coefficient of variation of the individual values of the time of the fraction, cV, c.u.	experimental	7,35***	0,98	0,003	-4,20	<0,001
	control	8,52	1,02	0,008		
Response time to sound stimulus, ms	experimental	751,18***	10,35	2,63	-21,35	<0,001
	control	812,50*	10,30	0,24		
Stability of reaction to sound stimulus, coefficient of variation of individual values of time of a particle, cV, c.u.	experimental	7,30***	1,013	0,01	-3,84	<0,01
	control	8,44	1,11	0,01		
Throwing a bag of sand with the right hand, m	experimental	2,90	0,75	0,14	0,46	>0,05
	control	2,81	0,66	0,13		
Throwing a bag of sand with the left hand, m	experimental	2,51	0,68	0,13	0,11	>0,05
	control	2,49	0,61	0,12		
Running 10 m, s	experimental	3,06***	0,34	0,06	-2,21	<0,05
	control	3,33*	0,51	0,10		
Leap length from place, m	experimental	0,73*	0,14	0,02	1,11	>0,05
	control	0,69	0,12	0,02		
Time to run the test on equilibrium, s	experimental	10,52***	1,46	0,28	2,54	<0,05
	control	9,43*	1,61	0,33		
Score speech, points	experimental	8,26**	1,58	0,30	2,42	<0,05
	control	7,24*	1,46	0,30		

Note: \* - changes in the group as a result of the experiment are reliable at  $p < 0.05$ ; \*\* - changes in the group as a result of the experiment are reliable at  $p < 0.01$ ; \*\*\* - changes in the group as a result of the experiment are significant for  $p < 0.001$ .

Positive changes as a result of using the technique of performing movements in combination with poems in the age group of 3 - 4 years were observed in almost all indicators. In the age group 3-4 years, a significant improvement in the parameters of a simple reaction to light and sound stimuli was revealed (the reaction time to light decreased from 906.71 ms to 735.79 ms,  $p < 0.001$ , the reaction time to sound - from 840.93 ms to 751,18ms,  $p < 0.001$ ). The parameters of run speed 10 m (from 3.53 to 3.06 s,  $p < 0.001$ ), long jump from the place (from 0.64 m to 0.73 m,  $p < 0.05$ ). The development of speech in children in the experimental group was more pronounced than in the control group (Tables 4).

In the control group, these changes are less pronounced or not reliable (tabl. 4).

A greater number of significant differences were found between the test scores of the children of the experimental group compared with the control group after the experiment.

Thus, the complex application of poems about nature and exercise contributed to an increase in the development of psychomotor abilities of children 2-4 years old. We recommend the further use of the complex both in combination with other methods of preschool physical education, and as an independent, comprehensively developing.

#### **Examples of observation of children**

Boy, 4 years old, performing the first complex, got rid of a strong thoracic kyphosis, stiff neck and greatly overcome clubfoot. Girl, 2 years with gymnastics, got rid of nervous disorders.

The children's perception of the world became much wider and more diverse. The ability to animate everything in the world and invent all sorts of imaginable and inconceivable creatures, together with the ability to perceive the world from a poetic and artistic side, have grown very much.

Boy, 3 years old, noticing that there is still no moon in the evening sky, said: "There is not a moon for a long time. Probably, she turns in front of the mirror, in order to be more beautiful when she comes out". Once, after the thaw again the snow fell and frost hit, the kid said: "It was people who found, trampled on, it became dirty. Winter went home, changed and turned beautiful again".

Children practicing gymnastics in poems about nature become very caring towards animals and plants.

## Discussion

### *Folk roots of a combination of physical, mental and intellectual education of the child.*

In the process of historical development in different countries of the world, the most effective means, methods and forms of diverse upbringing of children were discovered and selected. Gradually, they were accumulated in the family ritual, where the leading role played the upbringing of the physical and spiritual health of the child (Lahno, Hanjukova, & Cherniavska, 2015; Lahno, 2017).

All peoples have games for children, which contain a combination of poems and movements. There are finger games, story games, outdoor games with verses.

### *The relationship between physical, mental and intellectual developments of children.*

A number of studies have been carried out (Arshavsky, 1972; Reilly, 2008; Kambas et al., 2012), that at the initial stage of the formation of a child, that is, from zero to 3-4 years, physical, mental and intellectual development are closely interconnected. Yes, children who have learned to swim before, creep, walk differ also in great intellectual, psychic and other abilities.

This suggests that in the early stages of child development, all aspects of his personality develop harmoniously and closely interrelated. And only later there is a division of its holistic development into separate components, which, as a rule, are directly opposite, that is, a time-honored child in mathematics, writing, painting, music is far from always sufficiently well developed physically. This situation is not natural, it is created by the artificial division of the holistic formation of the child into separate components, and at the same time there are losses of quality as a whole child development, as well as in individual components of his personality. However, great success in all areas of activity is achieved by harmoniously developed people, who differ both in good health and physical training, and in high intelligence, in excellent erudition, artistry, aesthetics and other qualities. Therefore, the task of modern pedagogy is to search and create methods that harmoniously affect all areas of child development, not sharing a complex and unique, holistic process on separate, virtually unbound components. They pointed out this Arshavsky (1972), Kozina et al. (2017).

It is known that every toddler needs physical education. But often there are difficulties in finding a technique that has a complex of characteristics: attractiveness and accessibility for children; simplicity for an adult; not high duration (no more than 20 minutes during the conduct); the complexity of the impact on psychomotor development (physical, intellectual, psychological, artistic, etc.). That's why we suggest in the practice of physical education with the kids the use of exercises performed under the verses.

Our study confirms the data of the authors who studied the integrality of the psychomotor development of children. Petrenko (2016) showed the influence of speech development on the cognitive functions of preschool children. Children suffering from speech disorders may experience difficulties in their cognitive activities, restrictions in communication, asociality and sensual exclusion. In the author's studies, positive effects of the proposed elements of dance-cognitive training were observed. The study suggests the need for an integrated approach for the development of speech, cognitive and motor abilities. In our study, a method is proposed that solves the problems of the complex development of the child by applying an effective and accessible technique.

The results we obtained are also a continuation of the studies of Petrenko and Filippov (2017), who showed that specially designed choreographic training in dance correction helps in the following: development of a sense of rhythm; strengthening the skeleton and muscles; improvement of memory, attention, thinking and imagination. The study also points to the integral nature of children's development, shows the need for a comprehensive combination of physical education, art, development of cognitive functions for speech development and other aspects of child development. In this regard, our research allows us to work on various aspects of the child's psychomotor development by applying a simple motor technique combined with poetry.

The proposed methodology unites many aspects of the child's psychomotor development. Social development is achieved through the natural themes of poetry, which develops openness and goodwill in the child. Emotional development occurs due to the abundance of positive emotions that causes the performance of these complexes. Artistic development is due to a large number of imitative movements, which are saturated with this technique. Moral development is achieved due to the natural orientation of the poems that awaken love for all living things. Aesthetic development is determined by the direction of poetry and exercises to reflect the beauty of nature. Spiritual development is determined by the focus of complexes on the manifestation of

perfection in nature and on the achievement of practitioners' perfection. In addition, gymnastics takes a little time and does not require much effort from the conducting adult, which is important now.

#### *Future research and limitations*

Application of the complex in the future.

It seems to us very promising to conduct research on the possibilities of using a set of exercises in verse for both healthy children and for children with developmental problems.

For example, it is very important to conduct research on the feasibility of applying the technique to children with the following deviations:

- 1) violations of posture (kyphosis, lordosis, scoliosis, flat feet);
- 2) muscle weakness;
- 3) autism;
- 4) speech development disorders;
- 5) neurosis of hysteria;
- 6) slow physical, mental and intellectual development;
- 7) recovery from injuries (postimmobilization period).

Further studies require the possibility of using the technique when the child is alone engaged with the parents of the house; in the manger and kindergartens; in health groups; in the groups of therapeutic physical culture (in this case, the duration of intensive exercises should be reduced and the opportunities of those involved should be more subtly taken into account).

#### **Conclusion**

1. The complex application of poems about nature and exercises contributed to an increase in the development of psychomotor abilities of children 2-4 years old. In the age group of 2 years, the most significant changes occurred in the times of a simple reaction to light and sound. The running time of the 10 m segment significantly improved both in the control and in the experimental groups, however, in the experimental group the change in this index is more pronounced. In the experimental group also more pronounced verbal develop as a result of the application of the technique.

2. In the age group 3-4 years, a significant improvement in the parameters of a simple reaction to light and sound stimuli was revealed. Significantly improved the performance of throwing a bag with sand right hand, a long jump from the seat. In the control group, these changes are less pronounced or unreliable. The development of speech significantly changed both in the experimental group and in the control group, but in the control group these changes were more pronounced.

A greater number of significant differences were found between the test scores of the children of the experimental group compared with the control group after the experiment.

3. It is recommended to use the integral technique of combining poems about nature and movements for the development of psychomotor abilities of children 2-4 years old.

**Conflicts of interest.** The authors have no conflicts of interest.

#### **References**

- Allhusen, V., Belsky, J., Booth, C.L., Bradley, R., Brownell, C.A., *Burchinal, M.*, ... Vandell, D.L. (2007). Age of entry to kindergarten and children's academic achievement and socioemotional development. *Early Education and Development*, 18(2), 337-368.
- Arshavsky, I.A. (1972). *Age physiology essays*, Moscow: Science. (In Russian)
- Barnett, L.M., E. van Beurden, P.J. Morgan, Brooks, L.O., & Beard, J.R. (2009). Childhood motor skill proficiency as a predictor of adolescent physical activity. *J. Adolesc. Health.*, 44, 252-259.
- Bondarenko, S.V. (2017). Adaptive characteristics of main muscular groups' static endurance in 6 years children in initial school period. *Pedagogics, Psychology, Medical-Biological Problems of Physical Training and Sports*, 21(4), 157-162. doi:10.15561/18189172.2017.0402
- Cools, W., DeMartelaer, K., Vandaele, B., Samaey, C. & Andries, C. (2010). Assessment of movement skill performance in preschool children: Convergent validity between MOT 4-6 and M-ABC. *Journal of Sports Science and Medicine*, 9(4), 597-604.
- D'Hondt E.B., Deforche I. (2009). De Bourdeaudhuij, et al. Relationship between motor skill and body mass index in 5- to 10-year-old children. *Adap Phys Act Qu*, 26(1), 21-37.
- de Raeymaecker D.M. (2006). Psychomotor development and psychopathology in childhood. *Int Rev Neurobiol.*, 72, 83-101.
- del Río, M.F., Susperreguy, M.I., Strasser, K., & Salinas, V. (2017). Distinct Influences of Mothers and Fathers on Kindergartners' Numeracy Performance: The Role of Math Anxiety, Home Numeracy Practices, and Numeracy Expectations. *Early Education and Development*, 28, 939-95.
- Feder, K.P., Majnemer, A. (2007). Handwriting development, competency, and intervention. *Dev Med Child Neurol.*, 49(4), 312-7.

- Fisher A., Reilly J., Kelly L.A., Montgomery C., Williamson A., Paton J.Y., & Grant S. (2005). Fundamental movement skills and habitual physical activity in young children. *Medicine & Science in Sports & Exercise*, 37(4), 684–688.
- François, L.L., & des Portes, V. (2004). The main stages of psychomotor development from 0 to 3 years of age. *Rev Prat.*, 54(18), 1991-7. (in French)
- Hancock, R.E. (2017). Global Citizenship Education: Emancipatory Practice in a New York Preschool. *Journal of Research in Childhood Education*, 571-580. 10.1080/02568543.2017.1346731
- Jeppsson, F., Frejd, J., Lundmark, F. (2017). “Wow, It Turned Out Red! First, a Little Yellow, and Then Red!” 1st-Graders’ Work With an Infrared Camera. *Journal of Research in Childhood Education*, 31(4), 581-596. doi: 10.1080/02568543.2017.1347589
- Kambas, A., Venetsanou, F., Giannakidou, D., Fatouros, I. G., Avloniti, A., Chatzinikolaou, A., ... & Zimmer, R. (2012). The Motor-Proficiency-Test for children between 4 and 6 years of age (MOT 4–6): An investigation of its suitability in Greece. *Research in developmental disabilities*, 33(5), 1626-1632.
- Karia, R.M., Ghuntla, T.P., Mehta, H.B., Gokhale, P.A., & Shah, C.J. (2012). Effect of gender difference on visual reaction time: A study on medical students of Bhavnagar region. *IOSR-PHR*, 2, 452–454.
- Kotsopoulos, D., Makosz, S., & Zambrzycka, J. (2017). Number Knowledge and Young Children’s Ability to Measure Length. *Early Education and Development*, 28, 925-93.
- Kozina, Z., & Kozin, V. (2017). Kontsepsiya razrabotki tehnologiy integralnogo razvitiya i ukrepleniya zdorovya [The concept of developing technologies for integral development and health promotion] *Zdorov’â, sport, reabilitaciâ*, 1(1), 3-21. doi:http://dx.doi.org/10.5281/zenodo.579583(In Russian)
- Kozina, Z., Repko, O., Kozin, S., Kostyrko, A., Yermakova, T., & Goncharenko, V. (2016). Motor skills formation technique in 6 to 7-year-old children based on their psychological and physical features (rock climbing as an example). *Journal of Physical Education and Sport*, 16(3), 866-874. doi:10.7752/jpes.2016.03137
- Kozina, Zh.L., Kozin, V.Yu. (2009). *Young wizards. Cheerful children's gymnastics in poetry*. Kharkov. (In Russian)
- Kozina, Zh.L., Kozin, V.Yu., Iermakov, S.S., Krzheminski, M., Lahno, E.G., Bazyilyuk, T.A.....& Ilnitskaya, A.S. (2017). *Sistema sovremennyih tehnologiy integralnogo razvitiya i ukrepleniya zdorovya lyudey raznogo vozrasta: monografiyadlya [System of modern technologies of integral development and health promotion of people of different ages: monograph]*. Z.L. Kozina Eds. Kharkiv--Radom: Tochka. (In Russian)
- Lahno, O. (2007). Analysis of modern methods of cooperation of physical and intellectual child’s development. *Slobozhanskiy naukovo-sportivniy vIsnik*, 1, 7–11. (In Russian)
- Lahno, O., Hanjukova, O., & Cherniavska, O. (2015). Evaluation of the effectiveness of integrated psychomotor development of children in the age from 2 to 4. *Journal of Physical Education and Sport*, 15(4), 793 – 799.
- Lanphear, J., Vandermaas-Peeler M. (2017). Inquiry and Intersubjectivity in a Reggio Emilia-Inspired Preschool Jacquelyn Lanphear. *Journal of Research in Childhood Education*, 597-614. doi: 10.1080/02568543.2017.134841
- Petrenko, N. B., & Filippov, M. M. (2017). Potentials of speech disorders correction in 4-6 yrs children by means of ergo and art therapy. *Pedagogics, Psychology, Medical-Biological Problems of Physical Training and Sports*, 21(2), 75-81. doi:10.15561/18189172.2017.0205
- Petrenko, N.B. (2016). The methodical approach to determining the heterogeneity of cognitive function in preschool children requiring correction of speech impediments. *Pedagogics, Psychology, Medical-Biological Problems of Physical Training and Sports*, 20(2), 40-45. doi:10.15561/18189172.2016.0206
- Pop, C.L. (2016). Physical and health education facing the technology challenge. *Physical Education of Students*, 20(2), 45-49. doi:10.15561/20755279.2016.0207
- Reilly, J.J. (2008). Physical activity, sedentary behavior and energy balance in the preschool child: opportunities for early obesity prevention. *Proc. Nutr. Soc.* 67(3), 317–325.
- Svystun, J.D., Trach, V.M., Shavel, Kh.E., & Kukujuk, J.M. (2017). Hygienic aspects of physical education and health of schoolchildren. *Pedagogics, Psychology, Medical-Biological Problems of Physical Training and Sports*, 21(6), 301-307. doi:10.15561/18189172.2017.0607
- Volkov, P.B., & Nagovitsyn, R.S. Play technologies as means and method for developing the flexibility of the spine and children and adolescents movement coordination in sports activities in out-of-town health camps. *Pedagogics, psychology, medical-biological problems of physical training and sports*, 2018, 22(1), 667-671.
- Vilchkovsky, E.S., & Kurok, O.I. (2001). *Physical education of preschoolers*. Kiev: High School. (In Russian)