

Effectiveness of integral-developmental balls use in complex development of physical and mental abilities of senior preschool age children

VIKTORIA PASICHNYK¹, VALERYI MELNYK¹, LEVKIV VOLODYMYR¹, KOVTSUN VASYL¹

¹Department of sport and recreational games, Lviv State University of Physical Culture, Lviv, UKRAINE

Published online: December 26, 2015

(Accepted for publication November 11, 2015)

DOI:10.7752/jpes.2015.04118

Abstract:

Present physical education traditionally is considered only as a mean of optimizing the physical status of the person, which generally comes down only to the formation of motor capacity, health improvement of the younger generation at the expense of intellectual and socio-psychological development, which limits the possibility of integral formation of the person. In the practice of preschools observed the slow pace of integration of motor and mental development in children that is connected with not effectively organization process of traditional physical education. One of the reasons appears not fully understood in the society mind the multifaceted potential and importance of physical education for the integral formation of the person in the unity of its motor, intellectual abilities and moral qualities. This led to development of innovative programs based on qualitatively new integrative paradigm that reflects the unity and coherence of the motor and intellectual component of physical education of preschool children using integral-developmental balls allowing integrated health and educational effect. Learning in motion is one of the modern and perspective directions of motor and mental processes integration that means that development of physical and mental activity must be addressed as a single task. The results of implementation of “Smart Ball” program in the process of physical education indicate a significant results increase ($p < 0,01$) of children physical fitness in EG and CG, except for indicators of flexibility (torso incline from a standing position) in boys, where are false differences ($p > 0,05$). Children who were engaged in experimental program in seven of the eleven types of test achieved significantly higher results ($p < 0,05-0,01$) compared with children of CG that is shown in tests, “tossing and catching a ball”, “ball reflection from the floor”, “speed of brush movements”, “tennis ball throw”, “dynamometry of right and left hands”. Proved that at the end of the experiment indicators that characterize mental abilities got accurate dynamics ($p < 0,01$) in children of EG and CG. However, the increase of analyzed parameters in EG children had more pronounced upward trend, with six of the nine indicators children achieved significantly higher results ($p < 0,05$) compared with children with CG, especially in visual memory, speech, thinking (visual-figurative, visually-effective, logical-mathematical) and attention (amount).

Key words: physical and mental abilities, integral-development balls, senior preschool age children, effectivity.

Introduction

The trend of humanization of preschool education focuses specialists of physical education on the search for optimal ways of child harmonious development, building awareness of the need of continuous education, including the stage of transition from kindergarten to school. That is why a number of studies in recent decades aimed at the development and introduction to practice of physical education of preschool children some various technologies, programs and techniques of integrated development of physical and mental abilities (Vilchkovsky, 2004; Glazyrina, 2005; Moscalenko, 2011; Pangenova, 2013; Stepanenkova, 2006; Briskin, 2014).

However, despite the relatively wide range of the studied, it should be noted the insufficient coverage of issues of complex development of physical and mental abilities of preschool children using sports equipment, because is observed that in preschool age is intensive development of the world learning, the desire to interact with various objects. But unfortunately technologies offered to children, aimed at the development of physical qualities or mental abilities without their integration, and also are practically not used elements of different sports (Kozina, 2011; Pityn, 2015).

Thus, the problem of didactic support of the realization of a new conceptual approach to the organization of physical education, in the basis of which would be included complex development of physical and mental abilities in the context of a coherent and holistic preschooler personality is not enough studied, but extremely necessary in the light of modern requirements and determines the relevance of the study.

Aim of the research

Justification and experimental verification of physical education classes effectivity with use of integral-developmental balls for the complex development of physical and mental abilities of senior preschool age children.

Research organization

Studies were conducted at the kindergarten №165 in Lviv. For this was created control and experimental groups of 30 children 5 years of age who have formed by random sampling and which were similar by all indicators of physical fitness and mental abilities ($p>0,05$). Into the experimental group (EG) were included 15 girls and 15 boys, to the control (CG) – 14 girls and 16 boys. In CG all organizational forms of studies were conducted in accordance with the content and methodological recommendations of basic program “I am in the world”, where the movement action with integral balls is an obligatory component (balls used without didactic content). In EG the content in physical education was supplemented by developed material.

Methods

Theoretical analysis and synthesis of scientific and methodical literature, pedagogical observations, pedagogical testing, psycho diagnostic testing, pedagogical experiment, methods of mathematical statistics (determination of M, S, W-test of Shapiro-Wilk and Student’s t-test, correlation analysis, factor analysis).

Results

At preschool age, there are real possibilities for wide integration of body and movement, and cognitive activity of children, due to the distinguishing feature of a child in this age - the close relationship of the physical and mental development. The proposed program “Smart ball” is built with consideration of the conceptual problems of basic education programs of preschool children “I am in the world” and the program of senior preschool children “Sure Start”. The main purpose is to create the best opportunities for future success in school for children as well as to promote harmonious development of their personality. One of the main principles of the program “Sure Start” is the integrated approach to child education and development.

The aim of the program “Smart Ball” is a complex development of physical and mental abilities of the child during exercising with the preferred use of integral-developmental balls. The purpose of the program is specified in health, educational and upbringing tasks which are to optimize physical and mental development of the child during exercising.

The program requires compliance with a number of scientific and methodological approaches that contain key educational statements for the construction of physical education process. These approaches are: active, synergistic, anthropological.

In accordance with a defined aim and dedicated tasks of experimental program implementation it included organizing classes on unity position of methodological approaches and with compliance of complex principles which are part of the methodology and reflect the statements of its content, reveal the logic of solving problems and outline the main rules for their implementation. Implementation of the “Smart ball” program in preschool practice happened with compliance of general principles of the national system of physical education: harmonious all-round personality development, health orientation, socialization during exercise. These principles include components of social factors (culture, upbringing, education) that provide comprehensive child development (Saikina, 2008). Core principle of the program realization was the principle of harmonious development of personality, because formation of the child by means of physical culture ensured unity of body and intellectual components.

Organization and conduction of classes occurred with compliance of didactic principles that reflect basics of pedagogical process (visibility, accessibility and individualization, consciousness and activity, gradual, systematic, strength and progression (Kruzevich, 2012).

To specific principles we took the following pedagogical principles: developing education, integrated impact, optimality, integration. The principle of developing education provided the involvement of the child in various activities such as: gaming, motor, cognitive and communicative. In developing training pedagogical influence outpace, stimulate, steer and accelerate the development of the abilities of the individual preschooler who is subject of the activity. Developing education aimed at development of the entire set of personality qualities of the child (unity of motor, intellectual and psychosocial components) and takes place in the zone of its proximal development (Podlasyi, 2004; Stepanenkova, 2006).

Content component of the program “Smart ball” determines the means and forms of work. The program includes the following means: complex gaming exercise, outdoor games, relay races, exercises and games with elements of sport (basketball, football), exercises of overall development with music, story exercises morning gymnastics by verse-recitative accompanied with the priority use of integral-developmental balls. In percent correlation on experimental program in the classes’ process were given to 40% of the total study time. In addition to used means, also were used other practical material which are recommended by educational program for senior preschool children.

Material and technical support of classes on the program “Smart ball” implied the existence of a set of integral-developmental balls (Prystypa, 2011; Pityn, 2013) which are represented in a wide range of colors (7 colors), corresponding to the colors of the rainbow (red, yellow, green, blue, blue, pink, orange) (Fig. 1). In both

hemispheres of balls depicted the letters of Ukrainian alphabet; numbers from 1 to 10; signs - period, comma, question mark, exclamation mark, minus, plus, more, less, equal, star, arrow; geometric shapes - circle, square, triangle, rectangle, oval, rhomb, pentagon, polyhedron; funny picture. Integral-developmental balls meet the following requirements: compliance with the age of children (diameter – 20-25 cm, weight – 100-130 grams); accessibility to the perception of the child; number of balls is equal to the number of children in the group; variation application; child stimulation to activity; the opportunity for solution the developmental task of the educational process.



Fig. 1. Integral-developmental balls (appearance)
(a. s. № 37947 Ukraine)

For use of the integral-developmental balls is characteristic versatility: ball is the subject (catching, transfer, throws, leading, reflection, rolling, etc.); ball is the obstacle (stepping, jump, crawling etc.); ball is a landmark: the position of the object in space (top, bottom, left, right, front, back, middle), motor action – to run, to jump, run around, crawl, roll etc.; location of the object (in front, behind, through, with, on, between, among, under); ball is a support (under feet, back, stomach, etc.).

With the development of physical abilities we made the emphasis on those who are most linked to the development of mental processes of children, so was made a justified choice of the best types of movements that were most relevant to the flow features of mental processes. The most appropriate is to develop coordination, speed, speed-strength and strength capabilities, which confirmed by the presence of informational and significant relationships in our study ($p < 0,05-0,001$) with indicators of mental sphere of children. Confirmed the existence of interdependence trends of physical and mental abilities of boys and girls in a such motor tests as “tossing and catching a ball” ($r=0,41$), “ball reflection from the floor” ($r=0,41$) “speed of brush movements” ($r=0,45$), “long jump from place” ($r=0,44$), “tennis ball throw” ($r=0,46$), with the perception. Established relationships between indicators of coordination ($r=0,26-0,37$), speed ($r=-0,26-0,45$), speed-strength ($r=0,28-0,39$), strength capacity ($r=0,33-0,43$), flexibility ($r=0,33-0,41$), strength endurance ($r=0,26-0,30$) with thinking, speech, attention and memory. The presence of correlation relationships between indicators of physical and mental abilities of children indicate appropriateness of pedagogical influence aimed at complex development of motor and mental spheres of senior preschool children during physical exercises.

Received results of the factor analysis allowed determining the optimal correlation of influence means on the development of physical abilities. As a result of factorization we found that regardless of gender the structure of physical fitness of preschool age children there are three latent factors that form complex structural and functional hierarchy of background and leading indicators and explain from 68,2 till 71,8% of total variance that evidence on a significant impact of indicators on motor area. Factor structure with boys is: first factor known as “speed, coordination in cyclic locomotion and speed-strength abilities” (30,6%); second factor – “Strength” (21,5%); Third factor – “manual agility” (19,7%); girls: first factor – “manual agility and speed-strength abilities” (37,0%); second factor – “speed” (16,0%); third factor – “coordination in cyclic locomotion” (15,3%). Despite some differences in the factor structure of the physical fitness of girls and boys, can be noted that the existence of common trends that are in dynamic and heterochrony of development of their main content components. Determining the main factors of the structure of physical fitness of 5 years old children, their degree of relationship and significant contribution determines the content of means of pedagogical influence on the development of physical abilities during physical exercises. With consideration of said above was carried allocation of time for the development of physical abilities during physical education classes : coordination component – 35%, speed component – 25% speed-strength component – 20%, strength component – 10%, endurance – 5%, flexibility – 5%.

When choosing intellectual tasks we take into account the basic provisions of the program “Sure Start”, the content of the educational process of physical education was supplemented by sections of educational information in areas of general cognitive, logical-mathematical and verbal development.

The impact on the child's mental sphere was achieved through multifunctional content of practical material. The relationship of physical and mental education was detected in the implementation of interdisciplinary connections when motor actions in gaming exercises, outdoor games and relays where performance was accompanied by questions, verse, counting, and mysteries. The use of integral-developmental balls as objects that have specific features (colors, didactic symbols) allowed to form knowledge and understanding in the following areas: formation of spatial orientation – the direction of movement (body and ball: forward and backward, right and left, up and down); location of the object (ball) relatively themselves and to any object (before, on, over, in, between, among, under); forming sensory standards (knowledge of colors, shapes, sizes, geometric figures); formation of time orientation and their components (seasons, months, days of the week; day composition; minute, hour); dialogue formation and coherent speech, enriching vocabulary (names of objects, their features, actions, features of the action); formation of mathematical representations (counting in different ways, the formation of numbers from units and from two smaller numbers, setting numerical equations, inequalities; solving the simplest arithmetic examples; logic tasks – a synthesis, comparison, classification; the concept of quantity and value); building knowledge of letters (vowels, consonants); mastering the alphabet; division of words into syllables.

The selection of practical material (gaming exercise, outdoor games, relay races, exercises and games with elements of sport) we comply with the following requirements: game material should be understandable, accessible and interesting to children; in each motor-intellectual task participants get enough physical activity and physiological norm of motor activity; motional and intellectual material of classes should match the content of the educational program for children of this age; the degree of difficulty should match the knowledge and skills of children; variety of game tasks are complemented and complicated considering physiological features of children.

The realization of “Smart Ball” program took place in the following forms of organization of physical education in kindergarten conditions: physical education classes; sports and recreational activities during the day (morning gymnastics in verse-recitative accompanied, outdoor games on the walk); independent motor activity; physical culture entertainment. During classes was provided dosage of physical activity by intensity (pulse mode within 100-160 beats per minute), duration and volume considering anatomical and physiological features of senior school age children. Correlation of different loads by nature and intensity during physical education classes was following: low intensity 10 – 15%, average 65 – 75%, large 15 – 20%.

One of the pedagogical conditions of child formation in physical activity is subject-developmental environment that encourages a child to motor activity. In the process of organizing physical education classes for creating interest in the exercise was provided use of various equipment (basketball baskets, gymnastics benches, wall bars, etc.), use of sports equipment in different sequences and variant approach by its application. We used ribbons, hoops, skipping ropes, gymnastic sticks, pins, ropes, blocks and except integral-developmental ball other various sized balls: small plastic diameter of 6-8 cm, tennis balls 5-6 cm diameter and medicine ball.

For creation of interest and novelty effect, we used techniques proposed by M.O. Runova (2007) which were modified by us for more efficient use of integral-developmental balls:

- creating the effect of novelty by changing the portable equipment;
- placement (hanging, attachment, etc.) on stationary and portable equipment (integral-developmental ball in the net, on elastic band, etc.);
- association of inventory in certain systems (obstacle etc.);
- various spatial location, rational change and alternation;
- the creation of different game zones (on the mat, on the grass, in the sand, etc.).

At the initial stage of the program “Smart Ball” tasks are performed under standard conditions, were used motor actions (individual, pair, group) with integral-developmental balls (as in a subject, landmark, obstacle) with uncomplicated intellectual tasks that were carried out using game method of training with the active role of the teacher. At this stage, the task performed by verbal instruction combined with the demonstration, used information receptive and reproductive teaching methods, ways of children organizing were front and group. The gradual complication of gaming exercises consisted in the difficulty incensement of their motor content (various combinations of basic movements and movements with the ball), increasing their volume, complexity of implementation rules, game situations, the conditions of conduction, interpretations and varying of intellectual component which was performed by the gaming and competitive methods. Along with varying tasks used pedagogical influence aimed at enhancing motor and mental activities (problem situation, creative assignments) provided a combination of teacher position “partner.” At this stage, children performed tasks for the verbal instruction of the teacher, ways organizations were wheel, circular and group training.

Analyzing the results of studies of children physical fitness, it should be noted that all indicators for the period of the experiment was significantly improved in CG and EG of boys and girls ($p < 0,05-0,01$). Exceptions are indicators of flexibility (torso incline from a standing position) in boys, where are false differences ($p > 0,05$). Comparison of data that were obtained at the end of pedagogical experiment show that children of EG in seven of the eleven types of tests achieved significantly higher results ($p < 0,05-0,01$) compared with children CG (Table 1).

Thus, at the end of the pedagogical experiment difference between the indicators of children EG and CG was in the “shuttle” run boys – 0,48 sec, girls – 0,49 sec; in tossing and catching a ball boys – 6,80 times, girls – 6,49 times; ball reflection from the floor boys – 2,13 times, girls – 2,58 times; speed of brush movements boys – 2,13 times, girls – 1,79 times; tennis ball throw boys – 1,29 m, girls – 1,33 m; dynamometry in right and left hands

in boys – 0,87 kg and 0,80 kg, girls – 0,86 kg and 0,88 kg respectively. In conditions of pedagogical experiment was found significant improvement ($p < 0.01$) for all tests in the mental sphere in CG and EG of boys and girls, but with different rates of growth (Figure 2). In children of EG is set a statistically significant increase in indicators of speech (boys – 45,0%, girls – 42,2%), logical-mathematical thinking (40,2% and 39,6% respectively), visual-figurative thinking (39,7% and 37,7%), visually-effective thinking (28,2% and 36,3%), perception (38,1% and 38,3%), visual memory (35,5% and 32,1%), auditory memory (25,0% and 26,1%) attention (amount) (27,2% and 31,6%), attention (switching and distribution) (19,9% and 20,1%).

Table 1. Indicators of physical fitness of experimental and control group children (before / after the pedagogical experiment) (n=60)

Tests	Gender	EG (n=30)	CG (n=30)	EG-CG	
				t	p
“Shuttle” run 3x10 m, sec	B	12,37±0,14 / 11,66±0,13**	12,40±0,15 / 12,14±0,17**	2,05	<0,05
	G	12,88±0,18 / 12,16±0,20**	12,80±0,15 / 12,65±0,17**	2,06	<0,05
tossing and catching a ball, amount	B	18,80±1,24 / 26,80±1,03**	18,12±1,30 / 20,00±1,30**	4,08	<0,01
	G	15,73±1,51 / 24,13±2,02**	15,50±1,62 / 17,64±1,66**	2,45	<0,05
ball reflection from the floor, amount	B	5,20±0,47 / 8,00±0,58**	5,31±0,48 / 5,87±0,46**	2,86	<0,01
	G	4,80±0,57 / 8,00±0,70**	4,90±0,60 / 5,42±0,64**	2,68	<0,05
running 30 m, sec	B	8,43±0,12 / 7,96±0,13**	8,39±0,12 / 8,06±0,13**	0,50	>0,05
	G	8,74±0,13 / 8,20±0,11**	8,69±0,12 / 8,38±0,10**	1,03	>0,05
speed of brush movements, amount	B	19,86±1,06 / 24,13±0,77**	20,43±0,85 / 22,00±0,68**	2,08	<0,05
	G	21,60±0,96 / 25,00±0,52**	21,35±0,77 / 23,21±0,67**	2,14	<0,05
long jump from place, cm	B	74,86±2,19 / 85,73±2,30**	75,87±2,80 / 83,62±2,23**	1,18	>0,05
	G	72,46±3,26 / 85,26±2,63**	73,92±3,43 / 83,71±2,89**	0,45	>0,05
tennis ball throw, m	B	6,60±0,48 / 8,64±0,42**	6,72±0,45 / 7,35±0,41**	2,11	<0,05
	G	5,76±0,47 / 7,40±0,39**	5,52±0,46 / 6,07±0,42**	2,09	<0,05
Dynamometry (right hand), kg	B	6,74±0,35 / 8,48±0,30**	6,60±0,28 / 7,61±0,29**	2,08	<0,05
	G	6,26±0,33 / 8,02±0,33**	6,20±0,22 / 7,16±0,25**	2,06	<0,05
Dynamometry (left hand), kg	B	5,89±0,25 / 7,56±0,28**	5,74±0,26 / 6,76±0,27**	2,06	<0,05
	G	5,30±0,29 / 6,90±0,32**	5,42±0,26 / 6,02±0,26**	2,07	<0,05
torso incline from a standing position, cm	B	3,50±1,04 / 3,80±1,03	3,68±0,91 / 3,99±0,86	0,10	>0,05
	G	5,34±0,71 / 5,70±0,63*	5,06±0,91 / 5,39±0,64*	0,34	>0,05
Push-ups, amount	B	17,73±1,10 / 18,93±1,07**	18,68±1,07 / 19,81±1,06*	0,58	>0,05
	G	14,20±0,94 / 18,20±1,07**	15,78±1,01 / 20,01±1,09**	1,17	>0,05

Notice: * – difference of indicators before and after the experiment is statistically significant with $p < 0,05$; ** – with $p < 0,01$.

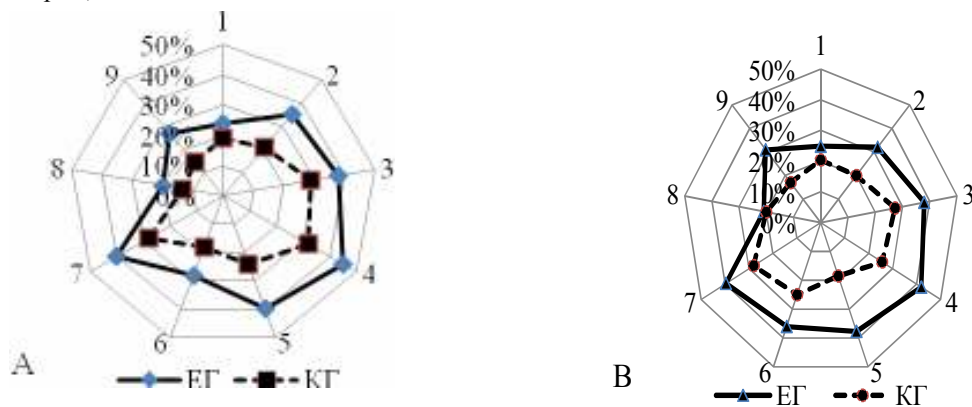


Fig. 1. Mental abilities indicators growth of boys (A) and girls (B) of control and experimental groups by the completion of pedagogical experiment (in %):

1 – auditory memory; 2 – visual memory; 3 – perception; 4 – speech; 5 – visual-figurative thinking; 6 – visually-effective thinking; 7 – logical-mathematical thinking; 8 – attention (switching and distribution); 9 – attention (amount).

Thus, the results of pedagogical experiment allowed establishing that children of EG, where sports and recreational classes were constructed on the basis of our program “Smart ball” greatly improved not only physical fitness indicators but also indicators of mental sphere.

Conclusion

Development of innovative programs based on qualitatively new integrative paradigm that reflects the unity and coherence of the motor and intellectual component of physical education of preschool children using integral-developmental balls allowing integrated health and educational effect. Learning in motion is one of the modern and perspective directions of motor and mental processes integration that means that development of physical and mental activity must be addressed as a single task.

The results of implementation of “Smart Ball” program in the process of physical education indicate a significant results increase ($p < 0,01$) of children physical fitness in EG and CG, except for indicators of flexibility (torso incline from a standing position) in boys, where are false differences ($p > 0,05$). Children who were engaged in experimental program in seven of the eleven types of test achieved significantly higher results ($p < 0,05-0,01$) compared with children of CG that is shown in tests, “tossing and catching a ball”, “ball reflection from the floor”, “speed of brush movements”, “tennis ball throw”, “dynamometry of right and left hands”. Proved that at the end of the experiment indicators that characterize mental abilities got accurate dynamics ($p < 0,01$) in children of EG and CG. However, the increase of analyzed parameters in EG children had more pronounced upward trend, with six of the nine indicators children achieved significantly higher results ($p < 0,05$) compared with children with CG, especially in visual memory, speech, thinking (visual-figurative, visually-effective, logical-mathematical) and attention (amount).

References

- Briskin Yuriy, Pityn Maryan, Zadorozhna Olha, Smyrnovskyy Serhiy, Semeryak Zoryana (2014) *Technical devices of improvement the technical, tactical and theoretical training of fencers*. Journal of Physical Education and Sport. №13 (2)
- Gavrysh N.V. (2011) *Integrational processes in preschool education system*. Announcer of Dnipropetrovsk university of economics and law №1 (1)
- Glazyryna L.D., Ovsyanik V.A. (2005) *Methodology of preschool age children physical education: tutorial for teachers*. Moscow. VLADOS.
- Haken H. (2004) *Synergetics: introduction and advanced topics*. Springer.
- Kozina Z. L., Lahno O. G., Moscalez T. V., Kondak N. M. (2011) *Integral development system of children 1–5 years old with use of technical devices*. Pedagogy, psychology and medico-biological aspects of physical education and sport № 9 (1).
- Kruzevich T. Y. (2012) *Theory and methodic of physical education*. Kiev. Olympic literature.
- Kruzevich T.Y., Tomenko O.A. (2009) *Non-specialized physical culture education of youth: conceptual approaches*. Theory and methodic of physical education and sport №3 (2).
- Moscalenko N. V. (2009) *Physcial education of youth pupils* [monography]. Innovation.
- Moscalenko N.V., Anastasieva Z.V., Sychova T.V., Lapshina N.G. (2011) *Physical education of preschool children: tutorial for students*. Innovation.
- Pangelova E. N. (2013) *Formation of a harmoniously developed personality of preschool children by physical education* [monography] Kiev. National University of Physical Culture and sport
- Pityn Maryan (2015) *Theoretical training in sport* [monography] Lviv. Lviv State University of Physical Culture
- Pityn Maryan, Briskin Yuriy, Zadorozhna Olha (2013) *Features of theoretical training in combative sports*. Journal of Physical Education and Sport №13 (2)
- Podlasyi I. P. (2004) *Pedagogy: 100 questions – 100 answers: tutorial for higher educational institutions*. Moscow. VLADOS.
- Pryshzhhepa S. S., Atroshchenko N. A., Semeshyna M. A. (2012) *Integrated physical education classes in preschool education*. Modern kindergarten. Moscow. ARKTI №1 (4).
- Prystypa Y. N., Vynogradskiy B. A., Petryna Y. V., Okopnyy A. M., Pasichnik V. M. (2011) *Methodic of integral-developmental balls use in mental and physical education of children: patent a. s. № 37947 Ukraine*. Registered 12.04.11.
- Runova M. O. (2007) *Child movement in kindergarten: tutorial for teachers*. Kharkiv. Ranok.
- Saikina E. G. (2008) *Fitness in modernization of physical culture education of children and youth in modern social conditions* [monography]. Education.
- Starodybzeva I. V. (2004) *Integration of mental and physical development of preschooler 5–7 years old in prosecco of physical education*. Thesis. Tumen.
- Stepanenkova Y. Y. (2006) *Theory and methodic of child physical education: tutorial for students*. Moscow. Academy.
- Vilchkovsky E.S., Kurok O.I. (2004) *Theory and methodology of physical education of preschool age children: tutorial*. Sumy. University book.