Gaming technologies in the development of spine flexibility and the coordination of children and teenagers' movements in sports classes in country health camps

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Authors' Contribution:
A – Study design; B – Data collection; C – Statistical analysis; D – Manuscript Preparation; E – Funds Collection.

Abstract

Purpose: to investigate the impact of gaming technology on the development of spine flexibility and movement coordination in children and teenagers.

Material: the study involved children and teenagers (n = 670, age 8-12 years). The duration of the study was 2 shifts (21 days each) in a country recreation camp. There were conducted 42 lessons. In the first shift, schoolchildren (n = 330, control group) were engaged in the program of physical education of additional education. The basis of the program were the following sections: athletics, mobile and sports games, gymnastics (morning exercises), mass sports and sports events. In the second shift, schoolchildren (n = 340, experimental group) were involved in author's program. In the control and experimental groups, the initial and final level of development of spine flexibility and coordination of movements (agility, accuracy) were assessed. Each participant is asked to perform 3 tests. The test was evaluated on a 5 point system.

Results: In both groups, positive changes in the development of spinal flexibility and coordination of movements were noted. The best dynamics is shown in the experimental group. This is explained by the following factors: an increase in the number of movements during the day on a certain group of muscles (morning exercises, mobile and sports games, massage, rhythm); concentration of motor activity on the development of spine flexibility and coordination of movements; a variety of gymnastic exercises; game form of employment.

Conclusions: the purposeful use of gaming technology for the development of flexibility of the spine and coordination of movements can improve the performance of children and adolescents.

Keywords: flexibility, spine, coordination, game technologies, children, teenagers.

Introduction

The organization of physical culture and sports work in children's health camps is not a new direction in science and practice. The organization and holding of mass sports and sports events during the summer holidays for children and teenagers has a health-improving orientation. In the mass physical culture and sports work general physical exercises, mobile and sports games are used, and physical culture activities are held. The main tasks are strengthening of health, promoting physical development and tempering the body, raising the body's functional level, physical and mental performance, fostering interest in physical education and sports.

Borodina I.A. [1] notes that under the health activity is meant the creation of a set of conditions and the implementation of measures to ensure the protection and promotion of the health of children and teenagers. The concept is expanded at the expense of preventive measures: preventive maintenance of diseases, sanitary - hygienic service, a diet and rest. The author introduces aspects of the physical culture: hardening of the body, physical training and sports. Milushkina O.Iu. et al. [2] revealed an improvement in the functional state of children in terms of indicators of physical development. The obtained results will allow optimizing the healing factors used in the summer camps.

Among the means of recovery Tanina N.A. [3] indicates the use of psychotherapy, nutrition, the use of mineral water. Other authors also note the importance of psychological work with children and young people [4]. In this case, it is necessary to take into account the individual characteristics of young people [5].

Novikova I.I. et al. [6] expand the range of facilities for improving children's health by air and sunbathing, cycling. Korotaeva E.V. et al. [7] determine the effectiveness of hydrotherapy: Jacuzzi baths, coniferous, pearl baths, circular shower, underwater shower massage, a complex of physiotherapy exercises, massage. In other studies, it is also recommended to use massage, laser therapy and cryotherapy for health promotion [8].

According to Guseva S.V. et al. [9] in the process of recovery, nurses play an important role. They participate in the health education of children on the issues of forming a healthy lifestyle, preventing diseases. The solution of the problems of the formation of healthy lifestyle is shown in other studies [10, 11]. The authors note the need for physical exercises. This allows to increase the functional potential of health.

Soboleva T.V. [12] revealed that the prospective in organizing a wide range of recreational and preventive activities is the stay of children in the country in-patient rest and recovery institution. Comprehensive rehabilitation of schoolchildren in summer camp conditions contributes to increasing the resistance of the child's organism to adverse effects. Wellness in the work of suburban children's camps contributes to reducing the

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incidence and improving the tolerance of students to the increasing physical stress in school. Rational organization of nutrition and movement in the health camp contribute to the positive dynamics of mass-growth indicators of children's physical development. The author notes the improvement of somatometric (length and body weight), and physiometric indicators (muscle strength of the hands, vital capacity of the lungs). Other studies confirm the need to increase physiometric indicators [13]. The authors give examples of optimizing body weight.

There are organizational problems in the work of children's health camps. For example, gender differences are not taken into account in working with children. According to Sagajdachnaia A.P. et al. [14], this factor reduces the effectiveness of health, rehabilitation, preventive work in children's team.

The main work on the physical culture and sports in the country health camps is conducted in the forms of organizing sports matches, friendly matches, sports festivals, folk games, fun [15]. We focus on limiting or reducing the motor activity of modern schoolchildren [16]. This statement is in tune with the position of Voronova B.Z. [17]. The author notes that the health risks of the children are influenced by the risk factors of the school environment: the high volume of educational and extra-curricular activities, the intensification of the learning process, the non-observance of the sanitary and hygienic norms of the organization of the educational process, the lack of exercise, unhealthy diet, the rigid mode of instruction, and the innovative type of educational institution.

According to Fomin N.A. et al. [18] priority in the development of motor conditions in school physical culture is given to the development of speed, strength, endurance. In our opinion, this circumstance explains the lack of skills in the manifestation of flexibility and coordination of movements in children.

Flexibility refers to the ability to perform movements with a large amplitude. Coordination of movements is understood as the processes of coordinating the activity of the muscles of the body, aimed at the successful performance of the motor task. Exercises on the flexibility of the spine and dexterity are effective only with regular exercises and a fairly large repetition of movements [19]. The development of flexibility is facilitated by special activities to maintain the posture [20]. The authors studied the relationship between leg position, flexibility, body weight among children aged 7 to 15 years. This study emphasizes the importance of evaluating the pediatric flat foot in the context of the developing organism. Kalina R.M. et al. note that sports contests contribute to the formation of the correct posture of children [21].

The choice of training orientation in the country health camp is determined by certain difficulties in the conduction of physical culture and sports classes: the choice of means, methods, manning detachments, medical and pedagogical control, determining the adequacy of physical activity, massiveness, undeveloped physical education infrastructure for conducting classes [22].

The advantages of suburban health camps include: the natural landscape, climatotherapy, the regime of the day, the use of a variety of training programs and pedagogical technologies [23]. Also, training tasks by means of sports, which contribute to the improvement of physical and functional structures of the organism [24]. Nordic Walking is an effective means of improving the level of health [25, 26]. Simplicity of such kind of exercises in walking makes these activities available for health camps.

Kriazh V.V. [27] notes that it is necessary to talk about complex of hygienic gymnastics for schoolchildren. This applies to schoolchildren who have statistical posture during the school day. Gymnastics of schoolchild has a recreational, correctional and athletic focus. It depends on the choice of exercises, the pace of the movements and the work of the muscle group. Other studies suggest methods for improving the bearing of children [28, 29]. The authors propose statistical models of children's figures in seated poses. This parametric model allows you to generate an infinite number of virtual children, covering a wide range of body sizes and poses.

The use of physical exercises increases the motor activity and physical performance [30]. In other studies, the direction of increasing physical performance is shown [31, 32]. The authors recommend to take into account the didactic patterns of training and optimizing physical loads. An important element in exercising is pedagogical control and the choice of adequate tests [33, 34]. Increased motor activity is closely related to sports and quality of life [35, 36].

One of the tools and methods for developing the flexibility of the spine and coordinating movements in children and teenagers is the use of gaming technology. Game technologies in physical education is a complex of approaches, methods, tools and techniques. All this is concentrated in gaming learning situations aimed at developing physical qualities.

The game plays an important role. The game is the most accessible and interesting tool in physical education. In the game activity special exercises are used: performing exercises in light and complicated conditions in team matches; the relationship between stretching and dexterity in the performance of game actions; use of the method of isolation of individual muscle groups [15]. Gaming exercises are widely used in various activities with young people [37, 38]. Such activities increase the emotional background and quality of instruction.

The effectiveness of the use of gaming technology in physical education is achieved due to the following factors:

- increasing the number of repetitions in one exercise;
- increase in amplitude and speed of movement;
- repeatability of exercises in the classroom;
- inclusion of additional movements (torso of the trunk forward, backward or to the side);
- application of medballs (medical ball) with teenagers and their throwing with both hands from behind the head or from the chest [39].

Hypothesis. It was assumed that the integration

of physical qualities of flexibility and coordination of movements in gaming activities, combinations of gymnastic exercises with varying amplitude of performance and exercises with objects will effectively promote the development of motor activities.

The aim of the work is to substantiate the influence of gaming technologies on the development of spinal flexibility and coordination of movements among children and teenagers in the conditions of a country health camp.

Material and methods

Participants. The study involved children and teenagers (n = 670, age 8-12 years), who have a rest in the country camp. The experimental group consisted of schoolchildren (n = 340), in the physical education of which game technologies were used to develop the flexibility of the spine and dexterity. When sending a child to a children's health camp, parents agreed to participate in the study.

Organization of the study. The experimental study (June-July 2017) was conducted on the basis of the children's health camp «Alye Zori» of the Udmurt Republic (Russia).

For 21 days of the camp shift, the spine flexibility and agility in children were developed: 20 morning exercises; 20 educational and training lessons; 26 mobile games; 7 sessions of back massages; 12 lessons of rhythmic; 8 competitions to determine the levels of development of spine flexibility and coordination of movements.

The average volume of motor actions on the spine and coordination of movements performed by each participant: morning exercises (160 repetitions); educational and training lesson (1140 repetitions); mobile game (from 120 to 160 repetitions); rhythmic (1600 repetitions); competition (from 80 to 120 repetitions).

According to the author's method each training session consisted of a warm-up (10 min.), main part (30 min.), final part (5 min.).

Teaching elements of the technique to carry out exercises on the development of coordination abilities was as follows:

- participants in the game performed movements with their hands, legs, trunk: simultaneous symmetrical actions, which do not need to be trained. Such movements are related to skills [40];

- in game situations, the following scheme was made more complicated: cross motions → successive movements → hand movements in different planes → asynchronous movements [41].

In the experimental group, mobile games were used to develop flexibility and coordination. The author made changes to the rules of the game in order to increase the amplitude of the players' movements.

Exercises: inclination of a torso forward, backward, to the side; circular motions; lifting legs in a sitting and lying position; waving of hands forward, back and sides [42]. The following phase are determined in the exercises: the phase of torso inclination back, the deflection phase and the rectification phase. The phase of torso inclination back is made by the functionality of the muscular and ligament apparatus of the lower back and the back of the thighs. Flexibility of the spine is manifested in all phases of exercise [43].

The method of isolating the leg muscles during the game is the position of the player sitting or in a squat. The use of this method prevents the impact of a shock wave from the lower limbs on the spine.

When performing the lifting of the legs in the sitting and lying position, active movements occur in the hip joint. The spherical shape of the joint anatomically allows you to make these movements in different planes. Therefore, this group of exercises is not dangerous and can be performed without compromising their health [44].

Short-term stay in the phase of torso inclination back, the phase of deflection and the phase of straightening does not entail a violation in the work of other organs and systems (blood circulation, nervous system and internal organs) [45].

We used games with moderate load (heart rate 101-120 beats per minute) – this is the main way of performing gaming exercises sitting or in a squat. With this method, the upper or lower limbs of the players are isolated. This allows you to increase the load on the parts of the body that perform the basic motor function in game situations.

Varying the load on the body was carried out by simplifying the rules of the game or complicating the performance of game exercises: reducing the size of the playing area; decrease or increase in the number of children playing at the same time; increase in the amplitude of motion; reduction or increase in distance, the height of the volleyball net; decrease or increase in the volume, weight of the ball; multiple repeatability of games during the day, weeks, shifts.

Inventory, placement. Classes were held daily in various zones: forest edge, glade, indoors. As inventory is used balls of different sizes, hockey sticks, tennis rackets, traps (boxes, caps, etc.), gymnastics sticks, skipping ropes, cue, volleyball net.

Exercise provided for mixed motor actions.

In the experimental group were used game technologies.

The control group of schoolchildren (n = 330) was engaged in the program of physical education of additional education. The basis of the program were sections: athletics, mobile and sports games, gymnastics (morning exercises), mass sports and sports events.

The testing was carried out at the initial and final stage of the study. Controlling tests were used to determine the level of physical development of spine flexibility and coordination of movements.

Test 1. The evaluation of the flexibility of the spine. Run from the starting position (sitting, hands in the sides behind, legs straightened at the knees) an inclination forward to the right leg. To fix 2 second. Repeat the inclination to the left foot. Evaluation: to reach the foot with your fingers - good (4 points); to get the foot with your palms – excellent (5 points).

Test 2. Evaluation of dexterity. Run out of the starting

position – sitting, legs straightened at the knees. In the hands of a «trap» (a wrapper box). The experimenter performs 5 throwing of a tennis ball from a distance of 6-8 meters towards the schoolchildren (the schoolchild is in the sitting position). Evaluation (out of 5 throwing the ball into a trap): 1-2 balls – satisfactory; 3-4 balls – good; 5 balls – excellent.

Test 3. Evaluation of accuracy. Execute from the starting position: sitting, the weight of the body rests on the left (right) hand behind; legs, straightened at the knees. Throwing a tennis ball at a target diameter of 1.5 m at a distance of 5 meters. Evaluation (out of 5 throws to hit the target) 1-2 times – satisfactory; 3-4 times – good; 5 times – excellent.

Statistical analysis. Determine: the average of the arithmetic mean (M) in each of the tests in each group; the mean square deviation (b); the mean error of the arithmetic mean (m). Also the calculation of the value of the t – Student's test.

Results

As a result of the study, we obtained comparative data in the control and experimental groups (Table 1).

Table 1 shows the dynamics of the physical development of the spinal flexibility and coordination of movements of children and teenagers in the experimental and control groups.

In both groups, positive changes in the development of spine flexibility and coordination of movements were noted, but the best dynamics is shown in the experimental group.

The positive dynamics in the development of spine flexibility and coordination of movements in children and adolescents is explained by the following factors:

- increase in the number of movements during the day for a certain group of muscles (morning exercises, mobile and sports games, massage, rhythmic);
- concentration of the child's motor activity on the development of spine flexibility and coordination of movements in physical culture and sports;
- a variety of gymnastic exercises and game form of exercises.

Discussion

Differences in the final indicators are explained by the use of special game exercises in the classes for the development of flexibility of the spine and coordination of movements.

These results confirm the study of Soboleva T.V. [12]. The author examined 250 children aged 7 to 15 years in «Beryozka» countryside health complex in June 2009. Anthropometric (mass and height) and physiometric parameters (hand dynamometry and vital capacity of the lungs) were used to screen the effectiveness of schoolchildren's recovery. At the end of the shift boys and girls improved their average performance in all parameters. Statistically significant changes ($p<0.001$) [12]. The author focuses attention in improving the dynamics of anthropometric indicators of children and teenagers due to the complex of recreational activities. In our study, gaming technologies were used to develop the flexibility of the spine and the coordination of movements in children and adolescents. Their application contributed to the formation of motivation to engage in physical education, levelling the process of psychological apathy, increasing motor activity, relieving tension.

Tumanian G.S. et al. [46] noted that the consequent effect on the muscle groups around the spine allows to obtain the desired training effect without a heavy load on the heart and joints. The authors pointed out: the regularity of classes, the manifestation of strong-willed effort, the overcoming of pain in the muscles.

The lessons we have organized with children and teenagers with the use of gaming technology in a country health camp provide an excellent opportunity to make the body more flexible, develop dexterity, accuracy. Our classes are somewhat different from others [6, 18]. We managed to reduce the number of problems in organizing classes with children compared to other studies [22]. The results of our experiment confirm the data of other studies [24, 30].

The intensity of physical activity in games is achieved by reducing the size of the site, the number of players, the time schedule; an increase in the number of times (periods), the number of repetitions. The volume of motor

Table 1. Dynamics of physical development of spinal flexibility and coordination of movements of children and teenagers in the experimental and control groups

№	Control test	Control group (n=330)		Experimental group (n=340)	
		Mom		M±m	
		Starting	Final	Starting	Final
1	Inclination to the toe (sitting)	2.3±1.12	3.2±1.04	2.2±1.06	4.6±0.4
2	Ball in a trap (sitting)	2.1±0.42	2.8±0.52	2.0±0.44	4.2±0.8
3	Throwing of small ball to the aim (sitting)	2.2±1.06	2.6±1.48	2.1±0.83	4.3±0.7

activity and the volume of motor actions on the spine and coordination of movements increased due to the diversity of content and forms of occupation. Game technologies in the motor activity of children and adolescents have proved their advantage in solving the local research problem – increasing the level of development of the spinal flexibility and coordination of movements in children and adolescents.

Conclusions

The study showed that the targeted use of gaming technology to develop the flexibility of the spine and coordinate the movements of physical education of children and teenagers can improve the performance of these physical qualities. The effectiveness of the gaming technologies used in the lessons is evidenced by the positive dynamics of indices of the spinal flexibility development and coordination of movements among schoolchildren.

Further research is supposed to be carried out in the validity of the use of gaming technologies in classes with children and teenagers in the conditions of a country recreation camp in teaching the technique of motor actions in sports games.

Conflict of interest

The authors state that there is no conflict of interest.

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